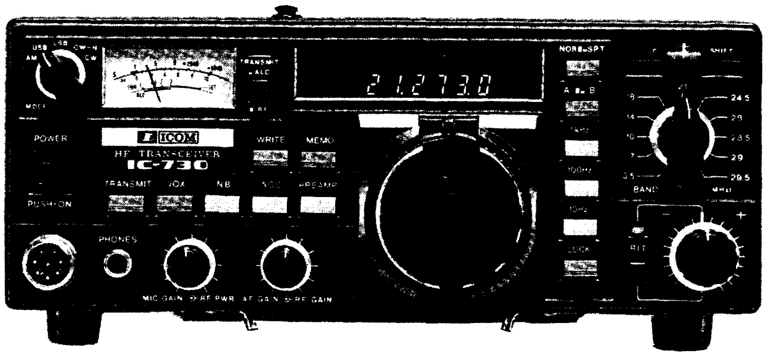
IC-730

HF ALL BAND TRANSCEIVER

INSTRUCTION MANUAL



ICOM

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SECTION 1 SPECIFICATIONS

GENERAL

Number of Semi-Conductors:

Transistors	71
FET	15
IC (Includes CPU)	25
Diodes	212

Frequency Coverage:

3.5MHz ~ 4.0 MHz
7.0MHz ~ 7.3 MHz
10.0MHz ~ 10.5 MHz (Receive Only)
14.0MHz ~ 14.35MHz
18.0MHz ~ 18.5 MHz (Receive Only)
21.0MHz ~ 21.45MHz
24.5MHz ~ 25.0 MHz (Receive Only)
28.0MHz ~ 29.7 MHz

Frequency Control:
CPU based 10Hz step Pre-mixed synthesizer.
Independent Transmit-Receive Frequency Available on same band.

Frequency Readout:
6 digit 100Hz readout.

Frequency Stability:
Less than 500Hz after switch on 1 min to 60 mins, and less than 100Hz after 1 hour. Less than 1KHz in the range of −10°C to +60°C.

Power Supply Requirements:
DC 13.8V ±15% Negative ground Current drain 20A max. (at 200W input)
AC power supply is available for AC operation.

Antenna Impedance:
50 ohms Unbalanced

Weight:
6.4 Kg

Dimensions:
94mm(H) x 241mm(W) x 275mm(D)

TRANSMITTER

RF Power:
SSB (A_3J) 200 Watts PEP input
CW (A_1) 200 Watts input
Continuously Adjustable Output power 10 Watts ~ Max.
AM (A_3) 40 Watts output
Continuously Adjustable Output power 10 Watts ~ 40 Watts

Emission Mode:

A_3J	SSB (Upper sideband and Lower sideband)
A_1	CW
A_3	AM

Harmonic Output:
More than 50dB below peak power output

Spurious Output:
More than 50dB below peak power output

Carrier Suppression:
More than 50dB below peak power output

Unwanted Sideband:
More than 55dB down at 1000Hz AF input

Microphone:
Impedance 1300 ohms
Input Level 120 millivolts typical
Dynamic or Electret Condenser Microphone with Preamplifier

RECEIVER

Receiving System:
Quadruple Conversion Superheterodyne with continuous Pass-Band Shift Control.

Receiving Mode:
A_1, A_3J (USB, LSB), A_3

IF Frequencies:

1st	39.7315MHz
2nd	9.0115MHz
3rd	455KHz
4th	9.0115MHz

with continuous Pass-Band Shift Control.

Sensitivity:

SSB, CW	Less than 0.3 microvolts for 10dB S+N/N
AM	Less than 0.6 microvolts for 10dB S+N/N

Selectivity:

SSB, CW	2.4KHz at −6dB
	4.8KHz at −60dB
AM	6.0KHz at −6dB
	18.0KHz at −60dB

CW-N
(when optional crystal filter installed)
600Hz at −6dB
1.5KHz at −60dB
(when optional AF filter installed)
150Hz at −6dB
1100Hz at −40dB

Spurious Response Rejection Ratio:
More than 60dB

Audio Output:
More than 2 Watts

Audio Output Impedance:
8 ohms

Specifications are approximate and are subject to change without notice or obligation.

SECTION 2 FEATURES

ALL BAND, ALL MODE, ALL SOLID STATE

The IC-730 covers all the Amateur HF frequencies from 3.5MHz to 29.9999MHz, including the new three bands of 10MHz, 18MHz and 24MHz. It offers not only SSB, but also AM and CW. All of the circuits in the IC-730, including the driver and final power stages are completely solid state, and provide about 100 watts output.

In addition, the low-pass filters switched by the BAND switch and the band-pass filters selected by an electronic signal from the CPU, make a no tune-up system.

OUTSTANDING RECEIVER PERFORMANCE

The IC-730 employs the ICOM DFM (Direct Feed Mixer) system and up-conversion system to improve a high receiver performance.

The ICOM DFM system is a system the incoming signals are directly fed to the first mixer, and the mixer is a high level Double Balanced Mixer developed by ICOM.

The up-conversion system uses a high side IF i.e., 39.7315MHz and high performance third over-tone crystal filters provide excellent image and IF rejection ratio.

These advanced devices and system give higher spurious response rejection ratio, higher sensitivity and wider dynamic range.

PASS BAND SHIFT CONTROL

The IC-730 has a built-in Pass Band Shift system that allows you to continuously adjust the center frequency of the IF pass-band. By moving the control, you can eliminate interference from a nearby signal, thus providing clear reception. It can also be used as a tone control.

When installed the optional crystal filter, FL-30, this system acts as a pass-band tuning system that allows you to continuously adjust the pass-band up to 800Hz from the upper or lower side in SSB and CW. It gives more performance to eliminate interference.

VARIOUS STEPS DUAL DIGITAL VFO

The dual digital VFO consists of a digital Phase-Locked-Loop by which controlled the Microcomputer Control System, and a pre-mixing circuit.

Three tuning frequency resolutions of 10Hz, 100Hz and 1KHz steps are selectable with the TUNING RATE switches.

Two separate VFO's can be used independently in the NORMAL (NOR) operation, and any desired in-band frequencies split transmit/receive in the SPLIT (SPT) operation.

MEMORY CHANNELS

The IC-730 has a frequency memory for each band. Any in-band frequency of the VFO A can be stored into the memory, and it can be recalled at any time.

ADDITIONAL CIRCUITS

The IC-730 has a built-in Noise Blanker, VOX, CW Monitor, APC, SWR detector, and many other circuits for your convenience.

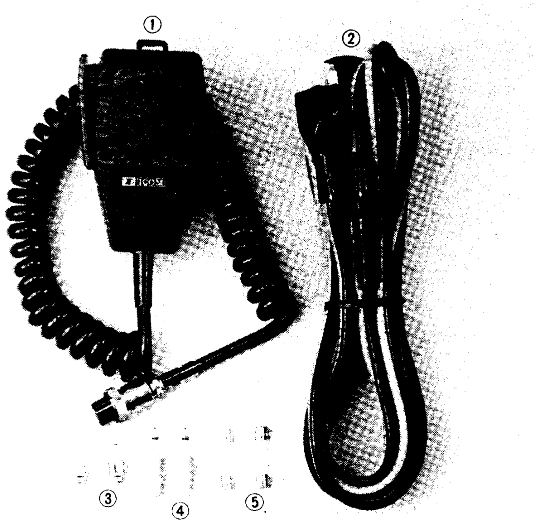
The IC-730 has everything you need to really enjoy HF operation, in an extremely compact, rugged transceiver.

SECTION 3 INSTALLATION

BE SURE TO READ THE FOLLOWING INSTRUCTIONS BEFORE USE.

3-1 UNPACKING

Carefully remove your transceiver from the packing carton and examine it for signs of shipping damage. Should any be apparent, notify the delivering carrier or dealer immediately, stating the full extent of the damage. It is recommended you keep the shipping cartons. In the event storage, moving, or reshipment becomes necessary they will be handy. Accessory cables, plugs, etc., are packed with the transceiver. Make sure you have not overlooked anything.



1. Microphone (IC-HM7) 1
2. DC Power Cord.......................... 1
3. Pin Plugs 2
4. External Speaker Plugs.................. 2
5. Spare Fuses (20 Amp) 2

3-2 RECOMMENDATIONS FOR INSTALLATION

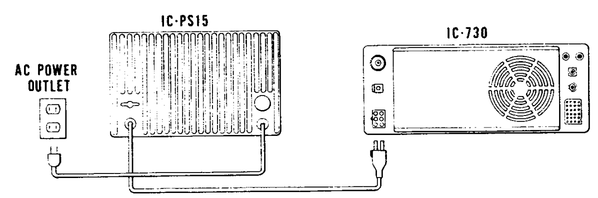
1. Avoid placing the IC-730 in direct sunlight, high temperature, dusty or humid places.
2. The temperature of the set will usually become relatively warm during transmission. Any equipment should be at least 1 inch (3cm) away from the unit so as to provide good ventilation. Be sure that nothing is on and just behind the rear PA heatsink to ensure good ventilation. Also avoid places near outlets of heaters, air conditioners etc.
3. Place the unit so that the controls and switches can easily be handled and the frequency indication and meter can easily be read.
4. For mobile installation, an optional mounting bracket is available. Select the best location that can stand the weight of the unit and that does not interfere with your driving in any way.
5. Use the Ground Lug!

3-3 POWER SUPPLY

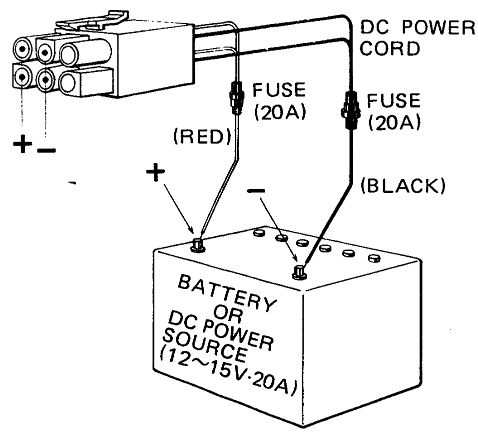
For AC operation, use the special power supply IC-PS15. If you would like to use your car battery or any other DC power supply, be sure that its output voltage is 12-15 Volts and the current capacity is at least 20 Amps. The maximum power consumption of the set during transmission runs from 16-20 Amps, so keep that in mind if the unit is installed in your automobile, and turn it on after you have started the engine. Attention should also be paid to the condition of the battery and electrical system.

The connection of the DC power cord supplied with the IC-730 is done in the following way: First make sure that the power switch of the unit is in the OFF position and the T/R switch is in the receive position. Connect the cord to the DC power supply with the RED lead to the positive terminal and the BLACK lead to the negative terminal. (Reverse connection will cause the protection circuit to operate and blow the fuse.) Connect the DC plug to the socket on the rear panel of the IC-730. Refer to the drawing below.

For AC operation



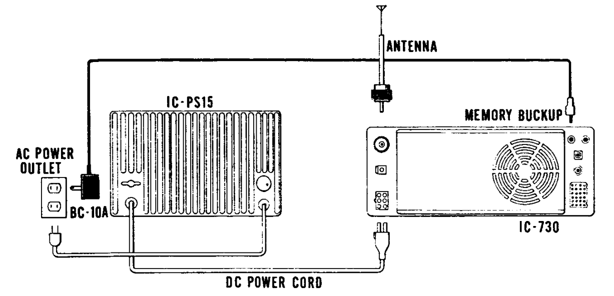
For DC operation



3-4 MEMORY BACK-UP

To retain the memory in the CPU, keeping the operating frequencies of the VFOs even when the main Power Switch is turned OFF, connect a power source of 9 to 12 Volts DC to the Memory Back-Up terminal on the rear panel. For mobile installation this can be accomplished by direct connection to the car battery, since the current drain is low.

For AC operation it is recommended that the optional BC-10A be used.



3-5 ANTENNA

Antennas play a very important role in radio communication. If the antenna is inferior, your transceiver cannot give you the best performance. With a good antenna and feeder cable having 50 ohm impedance, you should easily get the desired matching and performance. Carefully install a high performance antenna that suits the frequency band(s) you wish to operate on and place it as high as possible. Be especially carefull of the condition of the connectors as loose connections will deteriorate the performance. Be sure to connect the ground terminal of a whip antenna, if used, to the body of your car.

As the output is quite high, avoid connecting the antenna connector to open lines and do not transmit under mismatched conditions. Otherwise the final stage could be overloaded and cause a malfunction of the unit.

3-6 GROUND

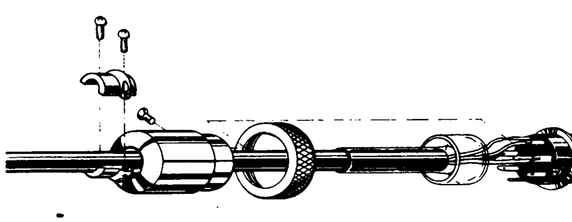
In order to prevent electrical shocks, TVI, BCI and other problems, be sure to connect a heavy wire ground, as short as possible, from a good earth point to the ground terminal on the rear panel.

3-7 MICROPHONE

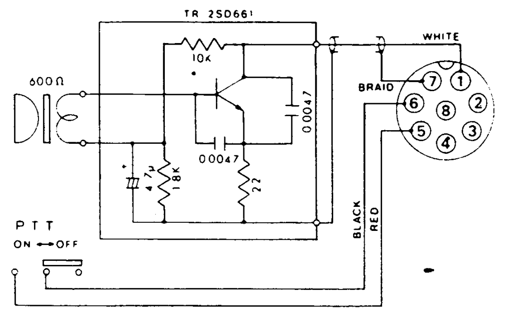
The microphone supplied with the IC-730 is the IC-HM7 which contains a preamplifier. The optional electret condenser type stand microphone IC-SM5 can be used. Their circuit diagrams are shown.

Should you wish to use a different microphone, make certain it has a proper preamplifier.

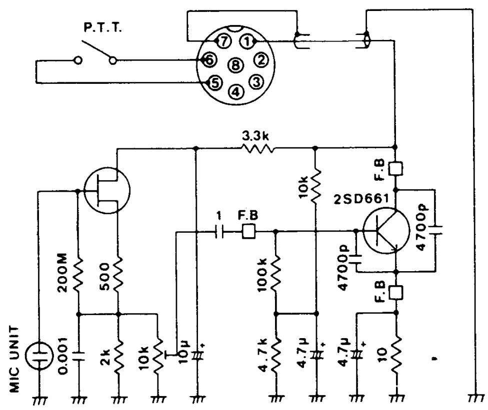
Microphone plug exploded view



Schematic diagram of IC-HM7



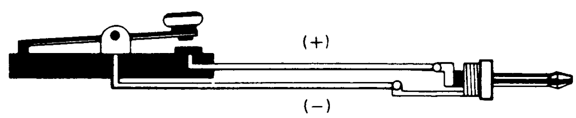
Schematic diagram of IC-SM5



3-8 CW KEY

When operating CW, connect the Key to the Key Jack with a 1/4 inch plug. The connection of the plug is shown below.

Key Wiring Diagram



If the terminals have polarity, be sure to make the correct connection. Note that the keyed voltage when switching with semiconductors or relays with resistors in the circuit, should be adjusted to be below 0.4 Volts!

3-9 EXTERNAL SPEAKER

The IC-730 contains an internal speaker, and is also designed so that it can drive an external speaker from the external (EXT) speaker jack on the rear panel. Be sure the impedance of the external speaker is 8 ohms, and remember that with the external speaker connected, the internal speaker is disabled.

3 - 10 HEADPHONES

Any good headphone set, including stereo type, that have 4-16 ohms impedance can be used. With the plug inserted halfway into the PHONES jack, both the headphone and speaker will operate. This is convenient when others wish to listen in on the station, or you wish to record contacts using a tape recorder connected to the headphone jack. With a stereo headphone set inserted this way, however, the headphone will lose the sound on one side. With the plug inserted completely, only the headphone works.

3 - 11 COOLING FAN

The rear of the PA unit is designed to provide for adequate cooling, but with 200 Watt input the final stage produces quite a bit of heat, and its temperature may rise during prolonged transmissions. The fan is connected to a temperature monitoring circuit which monitors the temperature of the final stage. The fan operates as follows:

1. The fan does not operate in the receive mode.
2. When the temperature rises to a point (75°C) detected by the monitor curcuit the fan will operate during both transmit and receive and much more rapidly to provide additional cooling. At this time stop transmitting and investigate the cause of overheating i.e., antenna mismatch, etc. Correct the cause of the overheating before starting to transmit again.

3 - 12 POWER SUPPLY

It is recommended that you use the IC-PS15 as a power supply for base operation. If you wish to use another type power supply make sure that it meets the voltage, current requirements. Note carefully the overvoltage protection, for a runaway regulator can destroy the IC-730; be especially careful that more than 16 Volts cannot be supplied to the transceiver. Do not connect the power supply, antenna, accessory plug, or microphone with the Power Switch in the ON position. Be especially careful not to transmit without an antenna or dummy load hooked up. If the fuse blows replace it with a 20 Amp fuse, only after fixing the cause. Do not turn the Power Switch ON and OFF repeatedly for this way cause the readout to mis-display. Should this occur, turn the set OFF and wait for approximately 30 seconds before turning it back ON.

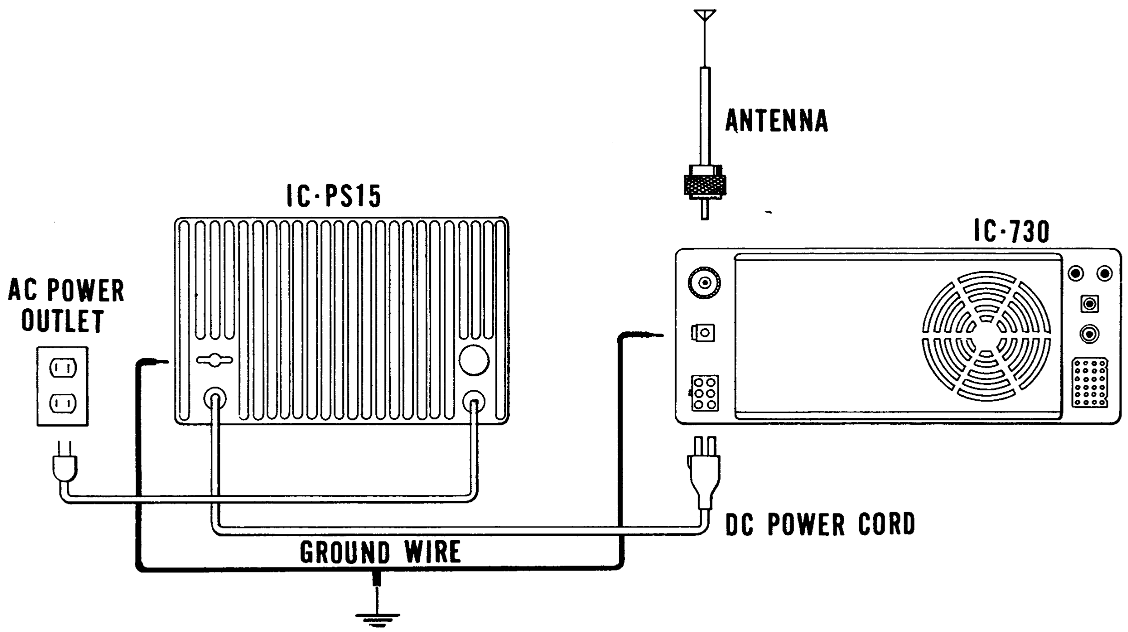
3 - 13 CAUTIONS

As the unit has already been closely adjusted with highly sophisticated measuring instruments, never taper with the turnable resistors, coils, trimmers, etc.

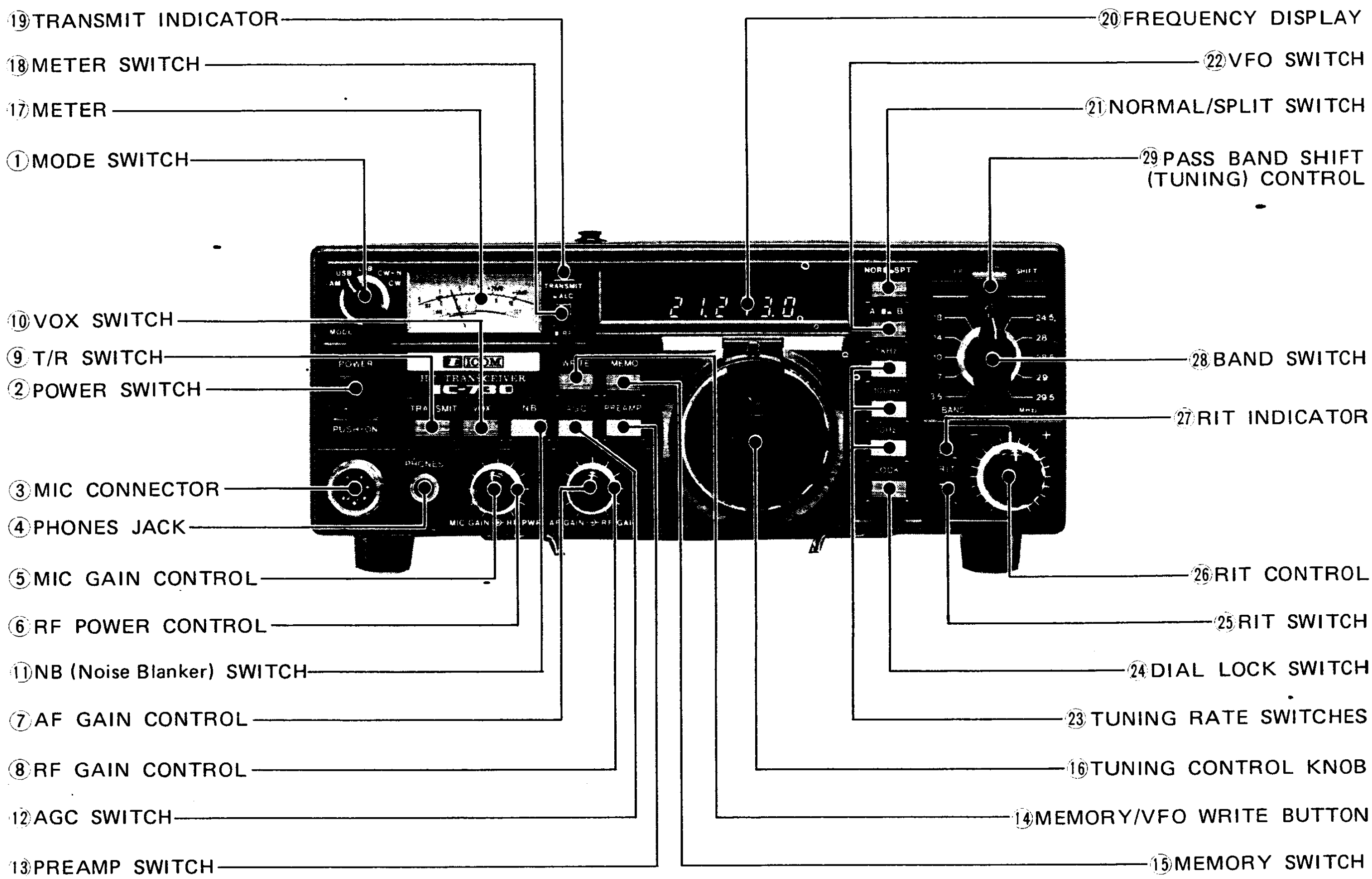
C-MOS is used in the Logic unit as well as the PLL. C-MOS ICs are very susceptible to excessive static charges and over current and care must be used when handling them. Therefore, avoid touching the Logic unit and the nearby circuitry unless absolutely necessary. When it is necessary to check the circuitry, observe the following points.

Ground all measuring instruments, the soldering iron, and other tools. Do not connect or disconnect the C-MOS IC from its socket, or solder it when the power is on. Do not apply voltage of less than –0.5 or more than +5 Volts to the input terminals of the IC. DO NOT MEASURE WITH AN OHMMETER.

Cable connections



4-1 FRONT PANEL



1. MODE SWITCH

This switch selects the mode of operation for both transmit and receive.

USB	Upper Sideband, mainly for 10, 14, 18, 21, 24 and 28MHz bands.
LSB	Lower Sideband, mainly for 3.5 and 7MHz bands.
CW	Continuous Wave, for CW operation on all bands.
CW-N	Narrow CW. The narrow crystal filter is automatically turned ON in this position to improve selectivity when receiving. (When optional crystal filter installed)
AM	Amplitude Modulation.

2. POWER SWITCH

The POWER SWITCH is a push-lock type switch which controls the input DC power to the IC-730. When the external AC power supply (IC-PS15) is used, the switch also acts as the AC power supply switch. When the switch is pushed in and locked, power is supplied to the set. When the switch is pushed again and released, power is cut to all circuits except the PA unit. (When the BC-10A is used, power will also be supplied to the CPU. (Refer to page 3.)

3. MIC CONNECTOR

Connect the supplied microphone or optional microphone, IC-SM5 or IC-HM10 to this jack. If you wish to use a different microphone, refer to the drawing on page 4.

4. PHONES JACK

Accepts a standard 1/4 inch headphone plug for headphones of 4 ~ 16 ohms. Stereo phones can be used without modification.

5. MIC GAIN CONTROL

Adjusts the level of modulation according to the input of the microphone. Clockwise rotation increases the microphones gain. As the input will vary with different microphones and different voices, the knob should be turned until the Meter needle, in the ALC mode, begins to move slightly within the ALC zone. In SSB and AM modes, when the speech processor is in use, the MIC GAIN CONTROL sets the clipping limits, while the RF POWER CONTROL sets the RF drive level to the maximum power level, where ALC starts at the saturation point of the amplifiers.

6. RF POWER CONTROL
Controls the RF output power 10 Watts to maximum (SSB: 100 Watts PEP, CW: 100 Watts, AM: 40 Watts). Clockwise rotation increases the output power.

7. AF GAIN CONTROL
Controls the audio output level in the receive mode. Clockwise rotation increases the level.

8. RF GAIN CONTROL
Controls the gain of the RF section in the receive mode. Clockwise rotation gives the maximum gain. As the control is rotated counterclockwise, the needle of the METER rises, and only signals stronger than the level indicated by the needle will be heard.

9. T/R (TRANSMIT/RECEIVE) SWITCH
This switch is for manually switching from transmit to receive and vice versa. Set the switch to RECEIVE (out) and the IC-730 is in the receive mode. Set the switch to TRANSMIT (in) and it switches to transmit. When switching with the PTT switch on the microphone or with the VOX switch set to ON, the T/R switch must be in the RECEIVE position.

10. VOX SWITCH
This switches the VOX circuit ON and OFF. When it is in the ON (in) position, in SSB, T/R switching is accomplished by means of a voice signal. In CW operation, semi-break-in switching by means of keying is possible.

11. NB (NOISE BLANKER) SWITCH
When pulse type noise such as automobile ignition noise is present, set this switch to the ON (in) position. The noise will be reduced to provide comfortable reception.

The blanking time can be selected NARROW and WIDE, by the NB WIDTH switch under the access cover. It will be effective against any type noises.

12. AGC (AUTOMATIC GAIN CONTROL) SWITCH
For changing the time-constant of the AGC circuit. With the switch in the AGC position (out) the AGC voltage is released slowly, and thus is suitable for SSB reception. With the switch in the FAST (in) position, the AGC voltage is released faster, and the AGC is suitable for stations suffering from fast fading or when operating in the CW mode.

13. PREAMP SWITCH
Switches the preamplifier for the receiver.

14. MEMORY/VFO WRITE BUTTON
By pushing this button, A VFO's frequency is written into Memory, or one VFO's frequency is transfered to the other VFO.

15. MEMORY SWITCH
Push this switch when you wish to write a frequency into memory, or to call a memorized frequency.

16. TUNING CONTROL KNOB
Rotating the TUNING CONTROL KNOB clockwise increases the frequency, while rotating it counterclockwise decreases the frequency. The frequency is changed in 10Hz, 100Hz or 1KHz steps which is according to the TUNING RATE switches. One complete rotation of the tuning knob results in a 1KHz frequency increase or decrease in 10Hz steps, 10KHz in 100Hz steps and 100KHz in 1KHz steps.

17. METER
When in the receive mode the meter acts as an S meter regardless of the position of the meter select switch. Signal strength is indicated on a scale of S1-S9, and S9 to S9+60dB.

In the transmit mode the meter has two functions which are selected by the Meter Switch (18). They are as follows:

Po; Indicates the relative output power. SWR can be measured by placing the switch located inside the top cover to the SWR position.

ALC; In this position the meter functions when the RF output reaches a certain level.

18. METER SWITCH
Selects meter function in the transmit mode.

19. TRANSMIT INDICATOR
Illuminates when the transceiver is in the transmit mode.

20. FREQUENCY DISPLAY
The frequency of the IC-730 is displayed on a luminescent display tube. Since the 1MHz and 1KHz decimal points are displayed, the frequency can easily be read. The frequencies indicated are the carrier frequencies of each mode in AM, USB, LSB and CW.

Remember, if you turn the RIT SWITCH ON to change the receive frequency and rotate the RIT CONTROL knob, the frequency displayed will not change.

21. NORMAL/SPLIT (TRANSCEIVE/SPLIT) SWITCH
Selects the relationship of the two VFO's. In the NORM (out) position, one VFO is for both transmit and receive. In the SPT (in) position, one VFO is for transmit and the other is for receive.

22. VFO SWITCH
You can select either of the built-in two VFO's with this switch. It also selects the relationship of the two VFO's with the NORMAL/SPLIT switch. The switch performs the following operations according to its position.

A. (NORMAL) Selects the "A" VFO for both transmit and receive.

A. (SPLIT) Selects "A" VFO for receive and "B" VFO for transmit.

B. (NORMAL) Selects the "B" VFO in both transmit and receive.

B. (SPLIT) Selects "B" VFO for receive and "A" VFO for transmit.

23. TUNING RATE SWITCHES
The small vernier marks on the tuning knob are changed to correspond to 10Hz, 100Hz or 1KHz steps which is selected by pushing the switch either 10Hz, 100Hz or 1KHz.

24. DIAL LOCK SWITCH
After the IC-730 is set to a certain frequency for rag chewing, mobile operation, etc., push the DIAL LOCK switch the VFO is electronically locked at the displayed frequency, thus inactivating the operation of the tuning knob. To change frequency, the dial lock must first be disengaged by pushing and releasing the DIAL LOCK switch again.

25. RIT SWITCH
Switches the RIT circuit ON and OFF.

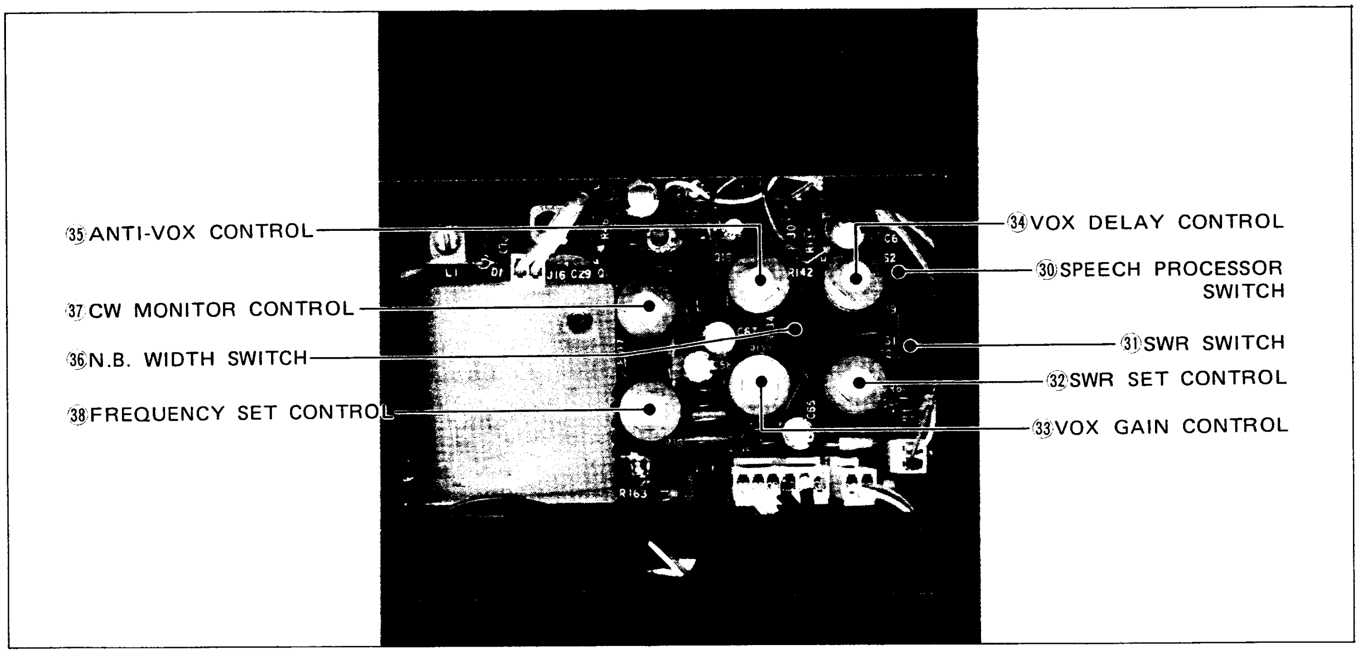
26. RIT CONTROL
Shifts the receive frequency ±800Hz either side of the transmit frequency. When the RIT is ON, the RIT INDICATOR is illuminated. Rotating the control to the (+) side raises the receive frequency, and rotating to the (–) side lowers the receive frequency. The frequency shift by tuning the RIT Control is not indicated on the frequency display.

27. RIT INDICATOR
Illuminates when RIT is turned ON.

28. BAND SWITCH
The BAND SWITCH is an 11 position rotary switch used for selecting one of the 500KHz segments. The selectable bands are 3.5KHz, 7MHz, 10MHz, 14MHz, 18MHz, 21MHz, 24MHz and 28MHz. (28MHz band is separated to four 500KHz segments.)

29. PASS-BAND SHIFT (TUNING) CONTROL
Allows continuous shifting of the pass-band from upper or lower side in SSB and CW. This will reduce interference by a nearby signal. When the optional crystal filter FL-30 is installed, this control allows continuous tuning of the pass-band selectivity by moving the filter up to 800Hz from the upper or lower side in SSB and CW. Not only improves selectivity, but also can improve the audio tone. Normal position is in the center position and is 2.4KHz wide in SSB.

4-2 CONTROLS UNDER THE ACCESS COVER



30. SPEECH PROCESSOR SWITCH
Switches the speech processor circuit ON and OFF. This circuit enables greater talk power and better results in DX operation.

31. SWR SWITCH
When measuring SWR, calibration SET and SWR reading functions are selected with this switch. When reading SWR make sure the METER switch on the front panel is in the RF position.

32. SWR SET CONTROL
This control calibrates the meter needle to the SWR SET position when you want to determine the value of SWR. The METER switch must be in the RF position and the set must be transmitting a carrier.

nicrophone to
SB, adjust the
e with normal

3 NTROL

The controls the transmit to receive switching time. Adjust it so transmit to receive switching will not occur during short pauses in normal speech.

35. ANTI-VOX CONTROL

In VOX (SSB) operation, the VOX circuit may be operated by sound from the speaker causing a switch to transmit. This trouble can be prevented by adjusting the input level of the ANTI-VOX circuit with this control along with the VOX gain control so that the VOX circuit only operates from the operator's voice, not by sound from the speaker.

36. N.B. WIDTH SWITCH

Switches the blanking action time of the noise blanker NARROW (short) and WIDE (long). Set the switch in the NARROW or WIDE position according to incoming noise.

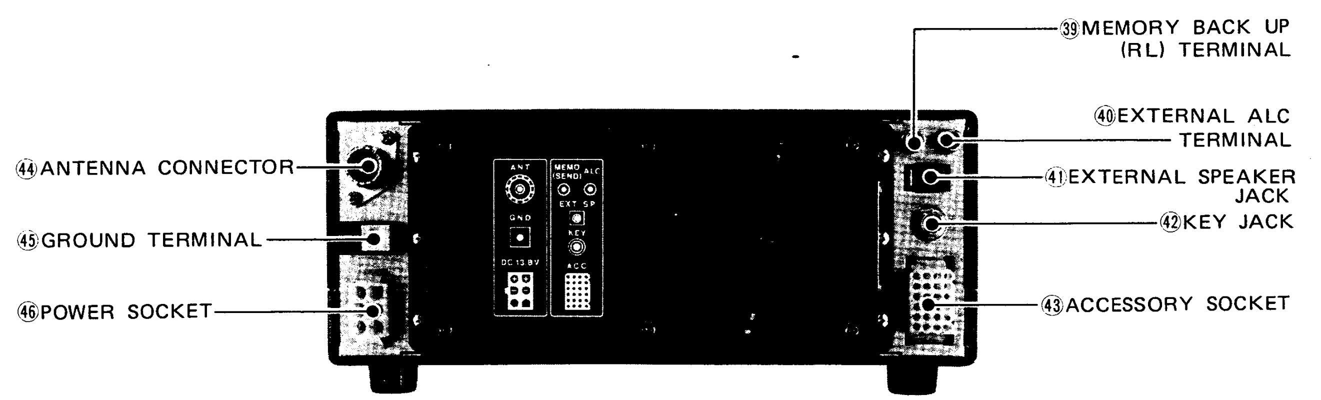
37. CW MONITOR (MONI) CONTROL

This control adjusts the audio volume of the side tone (monitor) audio during CW transmit operation. Adjust it to your desired level for easy listening.

38. FREQUENCY SET CONTROL

This control is for fine adjustment of the reference frequency of the PLL unit, which is local oscillator frequency. Do not turn it unless you want to change the frequency.

4-3 REAR PANEL CONNECTIONS



39. MEMORY BACKUP (RL) TERMINAL

For connection of a 9 ~ 12V DC power supply. For mobile installation connection to the vehicle's battery can be made the current drain is low, for fixed installation use of the IC-BC10A is recommended.

By changing an internal connector, this terminal can be used for Transmit/Receive relay control terminal. This terminal can be used to switch 24V 1A DC. Don't exceed this limit.

40. EXTERNAL ALC TERMINAL

This terminal can be used for input terminal of external ALC signal from a linear amplifier or transverter.

By using optional adapter, IC-EX205 and changing internal connectors, this terminal can be used for TRANSVERTER terminal.

VHF and UHF operation using a suitable transverter with the IC-730 is possible. This terminal is for Transverter connection. The output is a few milliwatts.

41. EXTERNAL SPEAKER JACK

When an external speaker is used, connect it to this jack. Use a speaker with an impedance of 8 ohms. When the external speaker is connected, the built-in speaker does not function.

42. KEY JACK

For CW operation, connect the key here. For electronic keying the terminal voltage must be less than 0.4V DC.

43. ACCESSORY (ACC) SOCKET

Various functions are available through the accessory socket such as modulation output, receiver output, T/R changeover, and so forth. The table below shows those terminals.

ACC SOCKET CONNECTIONS

PIN No.	FUNCTION
1.	NC (no connection)
2.	13.8 Volts DC in conjunction with the power switch operation.
3.	Connected to Push-to-talk, T/R change-over switch. When grounded, the set operates in the transmit mode.
4.	Output from the receive detector stage. Fixed output regardless of AF output or AF gain.
5.	Output from Transmitter MIC amplifier stage. (Input for MIC gain control stage.)
6.	8 Volts DC available when transmitting. (relay can not be directly actuated. Max. 5mA).
7.	Input for external ALC voltage.
8.	Ground
9.	NC
10.	8 Volts DC available when the 28MHz band is selected.
11.	Input for TRANSVERTER control. When 8 Volts DC is applied, set can operate with a transverter.
12.	Output reference voltage for band switching.
13.	Output for external band switching.
14.~24.	NC

ACC SOCKE

44. ANTENNA (ANT) CONNECTOR

This is used to connect the antenna to the set. Its imped ance is 50 ohms and connects with a PL-259 connector.

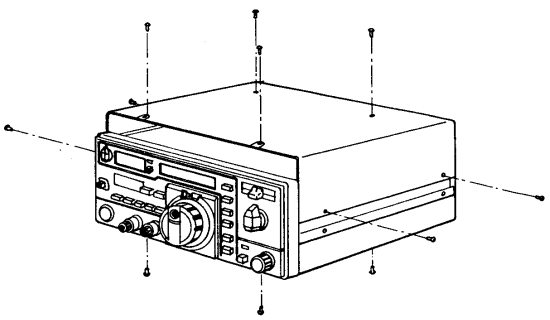
45. GROUND TERMINAL

To prevent electrical shock, TVI, BCI and other problems, be sure to ground the equipment through the GROUND TERMINAL. For best results use as heavy a gauge wire or strap as possible and make the connection as short as possible, even in mobile installations.

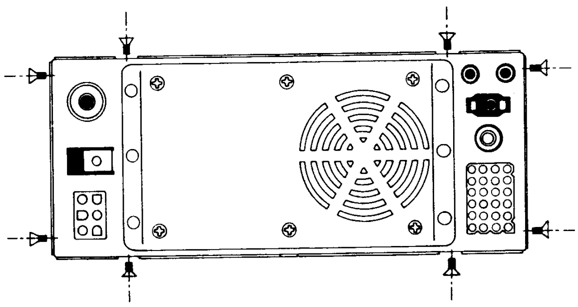
46. POWER SOCKET

For connection of the IC-PS15's DC power cord, or other suitable power supply.

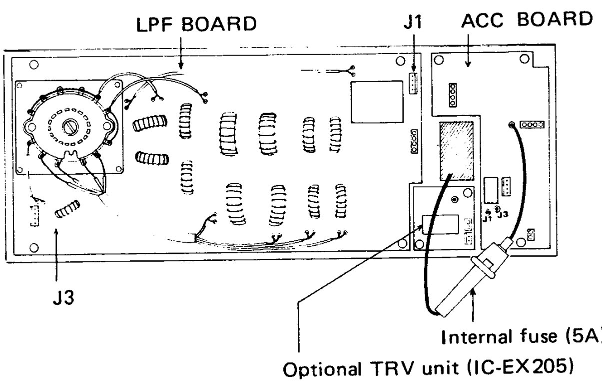
Procedure for changing the MEMORY BACKUP (RL) terminal function.



1. Remove the top and bottom covers.



2. Remove the eight screws at each end of the rear panel.
   Turn over the rear panel rightside, and unplug coaxial cables from J1 and J3 on the LPF board.



3. Change the plug P37 connection.
   When P37 is connected to J1 on the ACC board, the terminal functions as MEMORY BACKUP terminal.
   When P37 is connected to J3, the terminal functions as TRANSMIT/RECEIVE control terminal for an external set.

4. After changing connection, replace the coaxial cables, rear panel and covers with reverse procedure.

5-1 HOW TO TUNE

The following instructions are for tuning in any mode. Please read carefully and understand fully before turning ON your unit. Proper tuning is necessary for optimum operation.

5-1-1 FREQUENCY DISPLAY ON EACH MODE

When the set is first turned ON, the following readouts will appear on the FREQUENCY DISPLAY (when 7MHz and LSB are selected).



When changing to other modes, the display will be as follows:

USB:



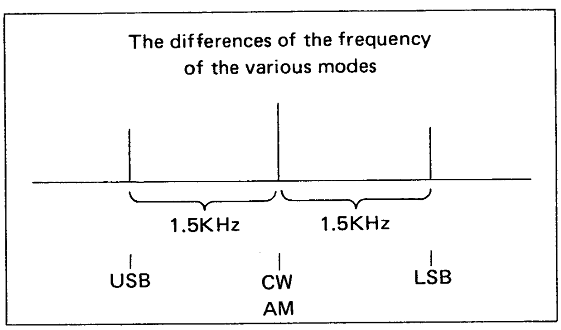
CW or CW-N (Narrow):



AM:



The displayed frequency shows the carrier frequency. To avoid the trouble of recalibrating the dial when you change the operating mode, the displayed frequency is set to shift to the carrier frequency of each mode automatically. For the differences of the frequency shifts of the various modes, refer to the following figure.



When changing to other bands, 100KHz and lower digits of the frequency display will remain previous ones.

EXAMPLE:

When the frequency display shows 14.255.5MHz, you switch to the 21MHz band, and the frequency display will show 21.255.5MHz. (When you switch to the 3.5MHz band, it will show 3.755.5MHz.)

5-1-2 TUNING CONTROL KNOB

The transmit or receive frequency is displayed on 7 segment Electroluminesent display down to 100Hz digits. Rotating the tuning knob clockwise increases the frequency, while turning counterclockwise decreases the frequency in which stops are selected by the TUNING RATE switches, i.e., 10Hz, 100Hz or 1KHz steps.

One complete rotation of the tuning knob results in 1KHz with 10Hz steps, 10KHz with 100Hz steps, or 100KHz with 1KHz steps, frequency increase or decrease.

Exact calibration is not necessary as the displayed frequency will always be correct but you may calibrate the scale on the tuning knob for use as an analog type frequency display.

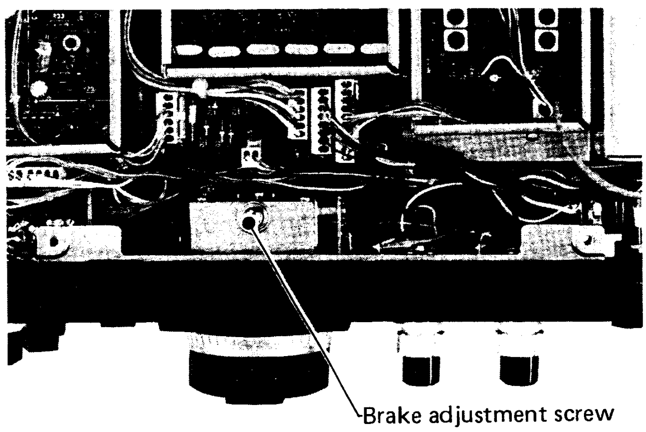
To calibrate the scale during operation, if desired, set the frequency readout to 0.0KHz, push the dial lock switch, then set the large increment on the tuning scale to line up with the indicator arrow and then push the dial lock switch again.

The tuning knob scale may require recalibration if you:

1. Turn the knob while the frequency is locked by use of the Dial Lock switch.
2. Turn the knob beyond the band edge.

Brake Adjustment

If the knob is too loose or too stiff for comfortable use, you can adjust the torque by tightening or loosening the brake adjustment screw accessable from underneath the set.



(It is unnecessary to remove the bottom cover for the brake adjustment.)

The following instructions should be used to adjust the tension of the Tuning Knob.

1. The Tuning knob tension will become tighter by turning the brake adjustment screw clockwise, and will become looser by turning the screw counterclockwise.
2. While performing this adjustment, the Tuning knob must be turned continuously as the screw is adjusted in order to set the tension for a comfortable touch.

The displayed frequency will not go beyond the highest band edge even by turning the tuning knob clockwise, or beyond the lowest band edge by turning the knob counterclockwise.

The frequency range of each band is shown in the following chart.

Band	Frequency Range
3.5	3.400.0 ~ 4.099.9
7.0	6.900.0 ~ 7.599.9
10.0	9.900.0 ~ 10.599.9
14.0	13.900.0 ~ 14.599.9
18.0	17.900.0 ~ 18.599.9
21.0	20.900.0 ~ 21.599.9
24.0	24.400.0 ~ 25.099.9
28.0	27.900.0 ~ 28.599.9
28.5	28.400.0 ~ 29.099.9
29.0	28.900.0 ~ 29.599.9
29.5	29.400.0 ~ 29.999.9

5-1-3 TUNING RATE SWITCH

Pushing one of the Tuning Rate switches will change the basic tuning rate of the set.

When pushed the 10Hz switch, the tuning rate becomes 10Hz. The 10Hz may be read from the increments on the tuning knob.

When pushed the 100Hz switch, the tuning rate becomes 100Hz.

When pushed the 1KHz switch, the tuning rate is changed to correspond to 1KHz steps. The last significant-digit on the display will remain previous one. This position will allow you to quickly QSY over a great frequency range.

5-1-4 DIAL LOCK BUTTON

After the IC-730 is set at a certain frequency for rag chewing, mobile operation, etc., pushing the Dial Lock switch the VFO is locked at the displayed frequency, thus inactivating the operation of the tuning knob. To change the frequency, the Dial Lock must first be disengaged by pushing and releasing the Dial Lock switch again.

5-1-5 VFO SWITCH

The CPU in the IC-730 contains two "VFO's" for both receiving and transmitting. The VFO's are labeled "A" VFO and "B" VFO and are selectable with the VFO Switch. This dual VFO system gives the IC-730 many very convenient features. Please read this section very carefully and perform the operation several times until you are comfortable with the system.

1. "A" VFO is for both transmitting and receiving and is selected by placing the VFO switch in the "A" position. The transmit and receive frequency will be controlled by "A" VFO, displayed on the frequency readout, and stored in "A" memory.

2. "B" VFO is for both transmitting and receiving and is selected by placing the VFO switch in the "B" position. The transmit and receive frequency will be controlled by "B" VFO, displayed on the frequency readout, and stored in "B" memory.

EXAMPLE:
When the set is turned ON (7MHz and LSB are selected), 7.101.5 will be displayed on the readout.
This will occur whether the VFO switch is in either the "A" or "B". Rotating the tuning knob clockwise will increase the frequency in 100Hz (10Hz or 1KHz) steps. Rotating the tuning knob counterclockwise will decrease the frequency in 100Hz (10Hz or 1KHz) steps.

■ Switching from one VFO to the other VFO does not clear the first VFO. The frequency is retained in VFO's memory.

EXAMPLE:
If 14.125.0MHz is set with "A" VFO, and the VFO switch is set to "B" VFO, the frequency readout will show "B" VFO's frequency, but 14.125.0MHz is still stored in "A" VFO's memory. Returning the VFO switch to "A" VFO position, and 14.125.0 will be displayed on the readout. Accordingly, if the switch is placed in the "B" VFO position, the frequency that was set with the "B" VFO will appear. This allows you to set a certain frequency with one VFO, work up and down the band with the other VFO, and periodically check the set frequency simply by switching between "A" and "B" VFO. It also allows you to search for a clear frequency with one VFO, while keeping your operating frequency on the other VFO. When you have found a clear frequency, switch back to your operating frequency, inform the station you are in contact with of the new frequency, and switch back. It's that simple!

5-1-6 NORMAL/SPLIT SWITCH

Pushing the NORMAL/SPLIT switch will change the relationship of the two VFO's. In the NOR (out) position, one VFO is for both transmit and receive. In the SPT (in) position, one VFO is for transmit and the other is for receive, so that this will allow you to operate split transmit/receive frequencies on the same band.

EXAMPLE:
Set "A" VFO to 7.085.0MHz and "B" VFO to 7.255.0 MHz.

Return the VFO Switch to "A" VFO then set the NORMAL/SPLIT Switch to the SPLIT position. 7.085.0MHz will shown on the readout during receive ("A" VFO) and 7.255.0MHz during transmit ("B" VFO). You are now receiving on 7.085.0MHz and transmitting on 7.255.0MHz. Setting the VFO switch to "B" VFO to reverses the above.

5-1-7 RIT (RECEIVE INCREMENTAL TUNING)

By using the RIT circuit, you can shift the receive frequency ±800Hz either side of the transmit frequency without moving the transmit frequency itself. Therefore, when you get a call slightly off frequency, or when the other station's frequency has shifted, you can tune in the frequency without disturbing the transmitting frequency. By

pushing the RIT switch once the RIT circuit is turned ON and the RIT Indicator is lit.
The receive frequency is shifted with the RIT Control knob.

When the RIT Control knob is in the "0" position, the transmitting and receiving frequencies are the same.

Rotating the control to the (+) side raises the receiving frequency, and rotating to the (–) side lowers the frequency. To turn OFF the RIT control, again push and release the RIT switch and the RIT Indicator will go OFF. When the RIT circuit is OFF, the transmit and receive frequencies are the same regardless of the setting of the RIT control knob.

NOTE: The RIT circuit is operational when the frequency is locked with the dial lock switch. The frequency shifted by turning the RIT control is not indicated on the frequency display. When the transmitting and receiving frequencies differ by more than 800Hz, use "A" and "B" VFOs.

5-1-8 MEMORY/VFO WRITE SWITCH

This switch allows desired frequencies to be written into the memories for each band, and allows either VFO's to be brought to the exact frequency of the other VFO without turning the tuning knob. Therefore, it is very easy to make a few KHz split transmit/receive frequencies.

EXAMPLE:
When "A" VFO is 14.255.5MHz and "B" VFO is 14.355.0 MHz, pushing the VFO switch to select "B" VFO, then the MEMORY/VFO WRITE Switch, "B" VFO's frequency becomes the same as "A" VFO's (14.255.5MHz). Now the "A" VFO's frequency is memorized in the "B" VFO, and you can operate anywhere with "A" VFO or "B" VFO. When you want to return to the previous frequency (14.255.5MHz), switch back to the other VFO. It's very easy. Also, you can make several KHz split frequency operation with "A" VFO and "B" VFO, in a moment. To reverse this (A the same as B), select "A" VFO first, then push the MEMORY/VFO WRITE Switch.

5-1-9 MEMORY OPERATION

MEMORY-WRITING
Only "A" VFO can be used for memory-writing.

1. Set the TUNING CONTROL knob to the desired frequency, using "A" VFO. For example, set it for 14.255.5MHz on the display (when 14MHz and USB are selected).
2. Push the MEMORY Switch. If no frequency has been programmed since turning the power of the unit ON, 14.098.5 (14MHz, USB) will be shown on the display and the unit will receive on this frequency.
3. One push of the MEMORY/VFO WRITE Switch erases the previous programmed frequency (14.098.5) and programs the new frequency (14.255.5) into memory.
4. Program any desired frequency into memory for each band in the same manner.
5. There is a memory for each band. The 28MHz band consists of four segments, and there is a memory for them. However, the memory can be used for all segments. For example when 28.055.0 is written in the memory, it can be used for 28.555.0, 29.055.0 and 29.555.0MHz also.

MEMORY-READING
Just push the MEMORY Switch. At whichever frequency the "A" or "B" VFO was set, that previously programmed frequency is recalled. When the MEMORY Switch is pushed again and released, the previous operating frequency of that VFO will again be shown on the display.

The programmed frequencies in the memories are maintained as long as the power, including MEMORY BACKUP power, of the set is not turned OFF, or new frequency reprogrammed. When a MEMORY BACKUP power source is connected, all programmed frequencies in the memories and the operating frequencies of both "A" and "B" VFO's are retained even when the POWER Switch is turned OFF.

5-2 SSB OPERATION

5-2-1 RECEIVING

After connecting an antenna, microphone, etc., set knobs and switches as follows.

POWER SWITCH	OFF (OUT)
T/R SWITCH	RECEIVE (OUT)
VOX SWITCH	OFF (OUT)
NOISE BLANKER (NB) SWITCH	OFF (OUT)
AGC SWITCH	SLOW (OUT)
PREAMP SWITCH	OFF (OUT)
VFO SWITCH	A (OUT)
TUNING RATE SWITCHES	Desired Rate
MODE SWITCH	USB or LSB
AF GAIN CONTROL	Completely Counterclockwise
RF GAIN CONTROL	Completely Clockwise
P.B. SHIFT CONTROL	Center position
BAND SWITCH	Desired Band
RIT CONTROL	OFF or Center (12 o'clock) position

Now turn ON the power switch. The meter lamp will be illuminated and [7.101.5] will be shown on the REQUENCY display (when 7MHz and LSB are selected).

In SSB operation there is both a USB (upper side band) and an LSB (lower side band). LSB is usually used on the 3.5 and 7MHz bands, while USB is usually used on the 10MHz band and above.

Slowly turn the AF gain control clockwise to a comfortable level. Rotate the tuning knob until a signal is received. The meter needle will move according to the signal strength, so tune for the highest possible meter reading and the clearest audio. If you cannot get a clear signal, you may be receiving in the opposite sideband. If so, change the mode to the proper sideband.

5-2-2 NB (NOISE BLANKER)

Turn the noise blanker ON (in) when there is pulse type noise, such as ignition noise from automobile motors. Noise will be suppressed and even weak signals will be received comfortably. When the N.B. WIDTH switch, located under the access cover, is set in the WIDE position, the noise blanker will effectively work for "woodpecker's noise", however, if the receiving signal is too strong, the noise blanker may work with the receiving signal itself, and some distortion may cause in the receiving audio or keying form. At this time, set the N.B. WIDTH Switch in the NARROW position, or turn the NB switch OFF.

5-2-3 AGC (AUTOMATIC GAIN CONTROL)

The IC-730 has a fast attack/slow release AGC system which holds the peak voltage of rectified IF signals from the IF amp circuit for a certain period. Therefore, during the pauses in normal speech of the received signal, uncomfortable noise will not be heard. The meter indicates the peak value for a certain period, facilitating reading of the meter "S" function.

For normal SSB reception, set the AGC switch in the OUT (slow) position. Set the AGC Switch in the FAST (IN) position, when tuning or receiving signals with short interval fading. When in the FAST position, the time constant is shortened.

5-2-4 PREAMP SWITCH

Turn the PREAMP Switch ON (in) when receiving weak signals. In the ON position, an RF preamplifier is inserted into the receiving antenna circuit, increasing sensitivity and giving easy reception.

5-2-5 PASS-BAND SHIFT CONTROL

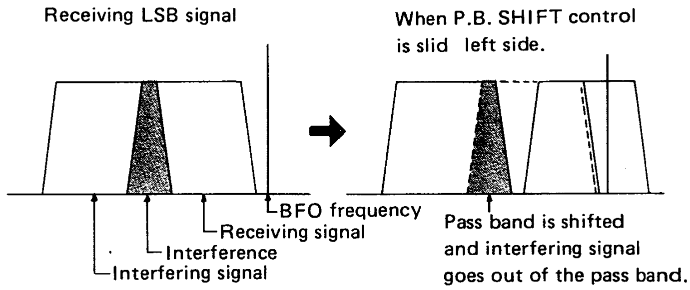
Pass-Band Shift Control is a system in the receive mode to shift the pass-band of the IF upper or lower side continuously. This is very effective in reducing interference from nearby signals.

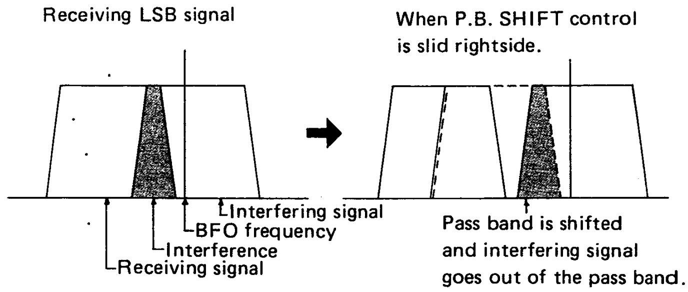
To use the Pass-Band Shift system, slide the control toward right or left side. The center position is the normal pass-band condition.

For example, while receiving in the LSB mode, if you get interference from a lower frequency (interfering signals are high pitched tones), shift the pass-band by sliding the P.B. SHIFT control left side. When the interfering signals are low-pitched tones, they are from a higher frequency, and you should shift the pass-band by sliding the P.B. SHIFT control right side.

When receiving in the USB mode, the pass-band is shifted in the opposite manner. Interference from a higher frequency will be high-pitched tones, and the P.B. SHIFT control should be slid right side. Interference from a lower frequency will be low-pitched tones and the P.B. SHIFT control is slid left side.

This control can also be used for audio tone adjustment, so it may be set for the most comfortable reception.

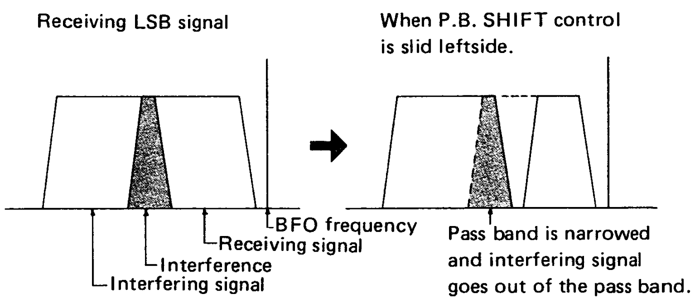


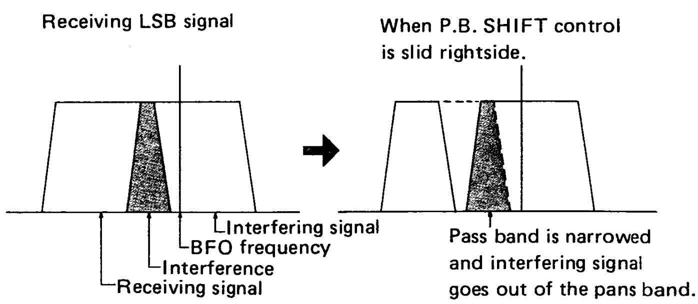


When the optional crystal filter, FL-30, is installed, the Pass-Band Shift system will be changed the Pass-Band Tuning system.

The Pass-Band Tuning (PBT) is a system in the receive mode to narrow the band width (selectivity) of the frequencies that will pass through the crystal filter electrically from either the upper or lower side continuously by up to 800Hz. This is very effective in reducing interference from nearby signals.

To use the PBT system, slide the control the same as the Pass-Band Shift system.
The center position is the widest position and is equivalent to the normal SSB band width.





5-2-6 TRANSMITTING

Before transmitting, listen in the receive mode to make sure your transmission will not interfere with other communications. If possible, use a dummy load for adjustment instead of an antenna. Set knobs and switches as follows.

MIC GAIN	CENTER (12 o'clock) position
RF POWER CONTROL	FULLY COUNTERCLOCKWISE
METER SWITCH	ALC (IN)

Other knobs and switches are left in the same positions as for receiving. When the T/R switch is moved to transmit, or when the PTT (push to talk) switch on the microphone is depressed, the TRANSMIT Indicator is illuminated. By speaking into the microphone, the meter needle will move according to the strength of your voice and SSB signals will be transmitted. Set the MIC GAIN control so that the meter needle stays well within the ALC zone at voice peaks. If you wish to increase the output power, turn the RF POWER Control clockwise and adjust to obtain the desired RF output power of between 10 watts and 100 watts (approximately).

Change to the receive mode by moving the T/R switch to receive, or release the microphone PTT switch.

5-2-7 HOW TO USE THE SPEECH PROCESSOR

The IC-730 has a low distortion AF speech processor which enables greater talk power and better results in DX operation. Follow the steps below for use of the Speech Processor:

MIC GAIN CONTROL Set to the CENTER (12 o'clock) position.

RF POWER CONTROL Fully Counterclockwise

SPEECH PROCESSOR SWITCH (under access cover) ON

Switch to transmit and turn the RF POWER CONTROL clockwise while speaking into the microphone until you obtain the desired RF "PEAK" output power of between 10 watts and 100 watts (approximately).

Adjust the MIC GAIN CONTROL to a point where the RF "AVERAGE" output power just saturates.

The Speech Processor should be turned OFF or MIC GAIN CONTROL carefully set for minimum compression for all communication other than DX operation for a very natural voice quality.

5-2-8 HOW TO USE THE VOX CIRCUIT

The IC-730 has a built-in VOX (voice operated relay) which allows automatic T/R switching by voice signals into the microphone. For VOX use, set the knobs inside the top access cover as follows:

VOX GAIN CONTROL
FULLY COUNTERCLOCKWISE
ANTI VOX CONTROL
FULLY COUNTERCLOCKWISE
VOX DELAY CONTROL
FULLY CLOCKWISE

Push the VOX switch on the front panel to the ON (in) position. Leaving the T/R switch in the RECEIVE position and without pushing the PTT switch, turn the VOX GAIN control clockwise while speaking into the microphone. At a certain point, the T/R switching circuit will be activated by your voice. This is the proper position for the VOX GAIN control. Set the VOX GAIN control at a level which provides for T/R switching at your normal voice level. Transmit-release time (the time delay before the set automatically returns to receive when you stop talking) is controlled by the VOX DELAY control. Turning the control counterclockwise makes the time shorter. Set it at a position which is comfortable and which allows for short pauses in normal speech.

Adjust the ANTI VOX control so that the VOX circuit is not activated by sounds from the speaker by turning the control clockwise while receiving a signal.

5-3 CW OPERATION

5-3-1 RECEIVING

For CW reception, set the MODE Switch for CW mode, or CW-N mode.

Other switches and knobs are set the same as for SSB reception.

In addition to the crystal band-pass filter, a Narrow filter (FL-45) and the AF band-pass filter (IC-EX203) are optional for this unit. When the MODE Switch is set at the CW-N mode, this filter is activated and the total selectivity of CW reception is improved (500Hz/–6dB). Also, the AF filter improves 150Hz/–6dB selectivity. With these filter, internal noise is reduced for comfortable CW reception and an improved signal to noise ratio (S/N).

If the optional CW filter is not installed the CW-N mode will have the same selectivity as the CW mode.

The Pass Band Tuning system can be used to narrow the band width up to 800Hz, the same as in the SSB mode.

Also, use the Noise Blanker, AGC switch and/or PREAMP Switch depending on the receiving conditions, the same as SSB reception.

5-3-2 TRANSMITTING

Insert the keyer plug into the KEY Jack on the rear panel of the unit, and set knobs and switches as follows:

RF POWER CONTROL	Fully counterclockwise
METER SWITCH	RF (OUT) POSITION

Other knobs and switches are set the same as for CW

reception.

By setting the T/R switch to TRANSMIT, the TRANSMIT indicator is lit and shows that you are ready for CW transmission. When you key the keyer, the meter needle moves and your CW signal is transmitted. To increase the transmitting power, turn the RF POWER Control clockwise to adjust while watching the meter needle on the Po scale for the desired output power.

5-3-3 CW SIDE-TONE (MONITOR)

When keying the side-tone oscillator is activated and a 800Hz tone will be heard. The loudness of the tone is controlled by the CW MONI Control located under the access cover. Rotating the control clockwise will increase the loudness. This tone is also audible in the receive mode and can be used for code practice, adjustment of the keyer, etc.

5-3-4 SEMI BREAK-IN OPERATION

The IC-730 has Semi Break-In CW capability when using the VOX function. When keying, the unit is automatically set in the transmit mode. After keying, it is returned to the receive mode, also automatically, after a given transmit-release delay time constant. Leave the T/R switch in the RECEIVE position, and set the VOX switch in the ON (IN) position.

The transmit release delay time constant is set by adjusting the VOX DELAY Control located under the access cover. Turning the VOX DELAY Control clockwise will make the transmit release time longer. Set for you keying speed.

5-4 AM OPERATION

5-4-1 RECEIVING

Set the operating mode for AM, by switching the MODE switch "AM". The other controls are the same as those for SSB reception, except the Pass Band Shift control. The Pass Band Shift control does not work in this mode.

When tuning an AM signal, tune for maximum signal strength as indicated on the meter.

5-4-2 TRANSMITTING

Transmitting AM signals is essentially the same as SSB transmission.
Set knobs and switches the same as for SSB operation. The RF output power can be adjustable between 10 Watts and 40 Watts. Also the speech processor can be used on this mode.

When transmitting the AM signals, the meter (in RF position) will indicate the carrier power, and the meter needle will move slightly according to your voice.

5-5 OTHER OPERATIONS

5-5-1 METER FUNCTIONS

The meter functions as an S-meter in the receive mode, and as the followings in the transmit mode, according to combinations of the METER Switch on the front panel, and SWR switch under the access cover.

RF meter : Indicates the relative output power on the Po scale.
ALC meter : Indicates the ALC condition.
SWR meter : Indicates the VSWR of the load on the SWR scale.

The combinations of the switch is positions for the meter functions are as the following chart.

METER FUNCTION	METER SWITCH	SWR SWITCH
RF meter	RF	SWR SET
ALC meter	ALC	—
SWR meter (calibrating)	RF	SWR SET
SWR meter (measuring)	RF	SWR

5-5-2 VSWR READING

The IC-730 has a built-in VSWR meter for checking antenna matching in order to avoid problems caused by VSWR. Set the METER Switch to the RF positions, and the SWR switch to the SWR SET position as the chart of 5-5-1. Set the operating mode to the AM, and push the TRANSMIT/RECEIVE Switch to TRANSMIT.

Adjust the SWR SET control located under the access cover so that the meter needle points to "SET" on the meter scale. Set the SWR switch to the SWR position. With the switch in the SWR position, SWR reading can be seen on the meter. Although this unit is built to handle VSWR of up to 2:1, it is recommended that the antenna(s) be adjusted for the lowest possible VSWR. After taking the reading, return the switch to the SWR SET position. ALSO BE SURE THAT THE ANTENNA IMPEDANCE IS 50 OHMS OR THERE MAY NOT BE ANY OUTPUT. OTHERWISE THERE WILL BE DAMAGE TO THE TRANSCEIVER.

The final transistors used in the IC-730 are of good design and are protected to a resonable extent by circuits incorporated in the set. These devices can be expected to have an indefinite lifetime since there are no cathodes to burn out. Under some conditions, however, they can be abused beyond tolerance and may have to be replaced.

When in doubt about antenna systems, use the lowest power setting possible to achieve meaningful readings. Use caution and exercise judgement when testing RF power generators.

5-5-3 WWV RECEPTION

To receive WWV (or other standard frequency station), set the operating band to 10MHz in the HAM band, and the MODE to any mode. Tune to 10.000.0MHz on the frequency display.

The WWV signal can be used for alignment of a frequency counter, marker oscillator, or the frequency display.

5-5-4 SIMPLE FREQUENCY ALIGNMENT

A very accurate frequency counter is necessary to align the frequency of the IC-730. However, the frequency can be aligned simply by receiving the WWV signal.

1. Set the frequency display to 10.000.0MHz and be sure that you are receiving the WWV signal.
2. Set the operating mode to CW. A 800Hz beat can be heard.
3. Short the KEY Jack on the rear panel so that the CW sidetone also becomes audible.
4. Rotate the FREQUENCY SET Control, located under the access cover, so that the two tones are of the same pitch (in zero beat). If the tones are difficult to adjust because of a difference in their strengths, adjust the CW sidetone level with the CW MONI control, also located under the access cover, until the strengths are the same.

When the optional marker unit, IC-EX195 is installed, operating frequency can be calibrated each 25KHz or 100KHz on the all bands.

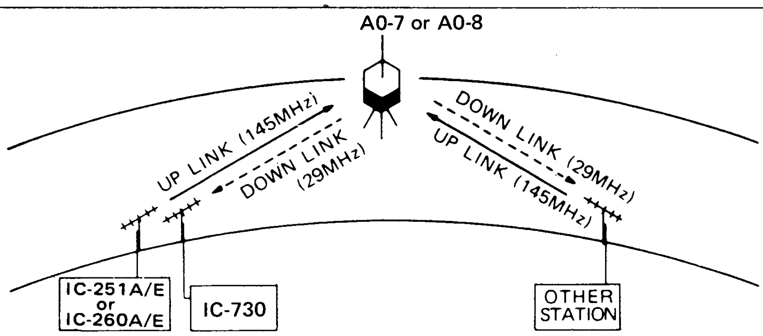
WHEN ALIGNING THE FREQUENCY, DO NOT PUT THE UNIT IN THE TRANSMIT MODE.

Be sure the T/R switch is in the Receive position, the VOX switch is OFF, and that you do not touch the PTT switch on the microphone.

5-5-5 SATELLITE COMMUNICATION

At present there are two active satellites for amatuer radio use, though more are being planned. AMSAT OSCAR 7 was launched in November, 1974, and AMSAT OSCAR 8 was launched in March, 1978. Satellite communications can be made by using an IC-251A/E or IC-260A/E for transmitting and the IC-730 for receiving. For operation, and frequency information, refer to the chart below.

Since communication satellites are moving at very high speeds, the down-link signals can be heard on a higher frequency than the real frequency as a satellite approaches, and on a lower frequency as it travels further away. Further information on communicating through satellites can be found in various amateur radio books and periodicals.



AO-7 · AO-8 FREQUENCY CHART
MODE A

UP LINK FREQUENCY	DOWN LINK FREQUENCY
145.85MHz	29.4MHz
145.95MHz	29.5MHz

BEACON FREQUENCY

AO-7	29.502MHz
AO-8	29.402MHz

5-5-6 TRANSVERTER CONNECTION

When the optional TRV unit, IC-EX205, is installed and the transverter control signal (+8V) is applied to Pin 11 of the ACCESSORY socket, the ALC terminal can be used for a VHF/UHF transverter INPUT/OUTPUT terminal.

The transverter's input/output frequency and signal level should be as follows:

- Transverter INPUT/OUTPUT Frequency
  28 ~ 30MHz
- Input/Output Level
  Transmit (Output) : Max. 150mV across a 50 ohm load
  Receive (Input) : 1μV for S/N 10dB

5-5-7 LINEAR AMPLIFIER CONNECTION

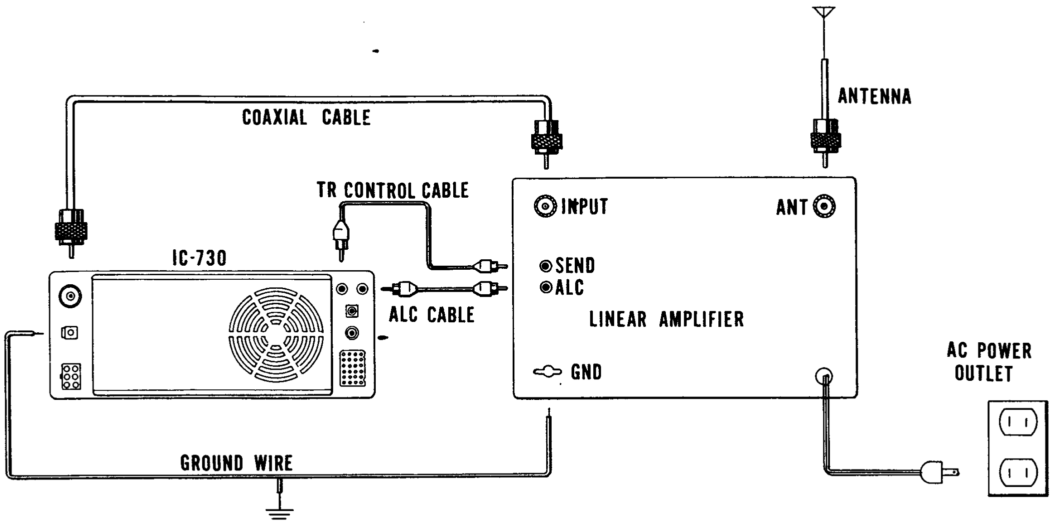
The jack on the rear panel marked MEMO (SEND) is dual function, running from this jack on the interior of the set is wire which is connected to Plug P37. When this plug is connected to J1 on the ACC board, memory backup function is available, when connected to J3, there is a relay built-in for keying a linear amplifier. (Refer to page 10.)

When installed optional LDA unit, IC-EX202, the IC-730 puts out the band control voltage to change operating band automatically for external equipment such as linear amplifier and antenna tuner. The voltage is put out from Pin 13 of the accessory socket. (Refer to page 10.)

Band Control Voltage Chart

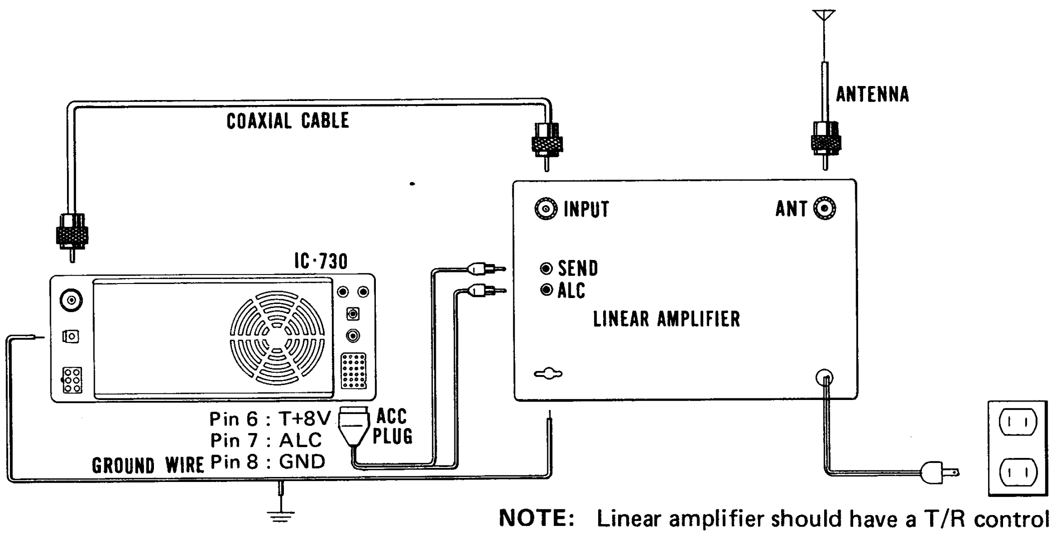
BAND (MHz)	Band Control Voltage
3.5	6.0 ~ 6.5V
7	5.0 ~ 5.5V
14	4.0 ~ 4.5V
18 - 21	3.0 ~ 3.5V
24 - 28	2.0 ~ 2.5V
10	0 ~ 1.2V

Cable connections with a linear amplifier



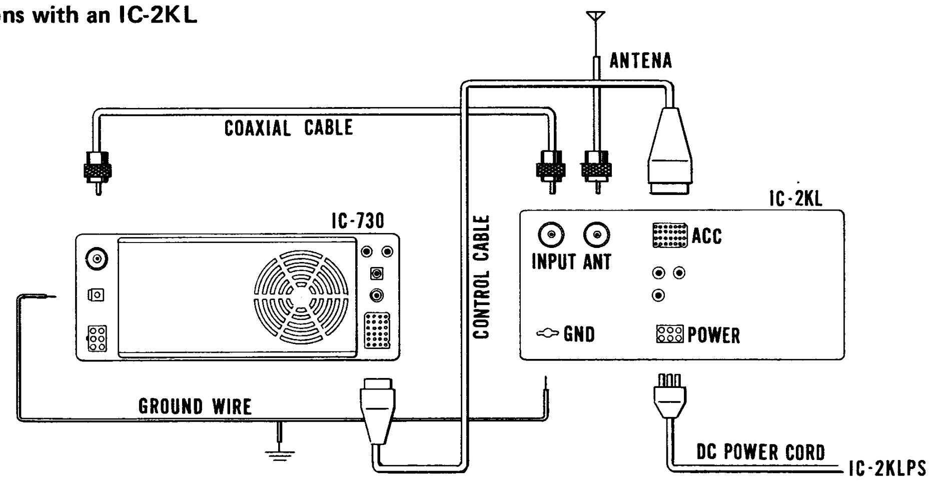
NOTE: Internal connection of the IC-730 should be changed. (Refer to page 10.)

Cable connections with a linear amplifier



NOTE: Linear amplifier should have a T/R control circuit which is actuated by +8V (max 5mA).

Cable connections with an IC-2KL



NOTE: IC-730 should be installed optional LDA unit (IC-EX202) for automatic band switching.

The IC-730 employs a pre-mixed local oscillator for both transmit and receive. The local oscillator consists of a digital phase-locked-loop controlled by a microcomputer system, and crystal oscillator for each band. The frequency of the local oscillator is approximately 39.7MHz above the operating frequency, thereby spurious is kept to a minimum.

The basic circuit uses an up-conversion with a First IF of 39.7315MHz and a Second IF of 9.0115MHz. The receiver front end employs the ICOM DFM (Direct Feed Mixer) system, that incomming signals are directly fed to the mixer, and provides wide dynamic range and high two-signal selectivity.

The circuits are divided several units. The units are:

6-1 LOW-PASS FILTER UNIT

The Low-Pass Filter Unit has a low-pass filter for each band and a VSWR detecting circuit.

During receive, the signal from the antenna passes through the Low-Pass Filter Unit which switches for the proper band eliminating the undesired signals from out-of-band, and then is sent to the RF Unit.

During transmit, the output signal from the PA Unit is fed to the Low-Pass Filter of the proper band and eliminates all harmonic components, then is fed to the SWR detecting circuit, and detected for forward power and reflected power, then are fed to the antenna terminal.

6-2 RF UNIT

This unit consists of a receiver preamplifier, band-pass filter for each band, first mixer, 39MHz crystal filters, receiver first IF amplifiers, and transmitter buffer amplifier.

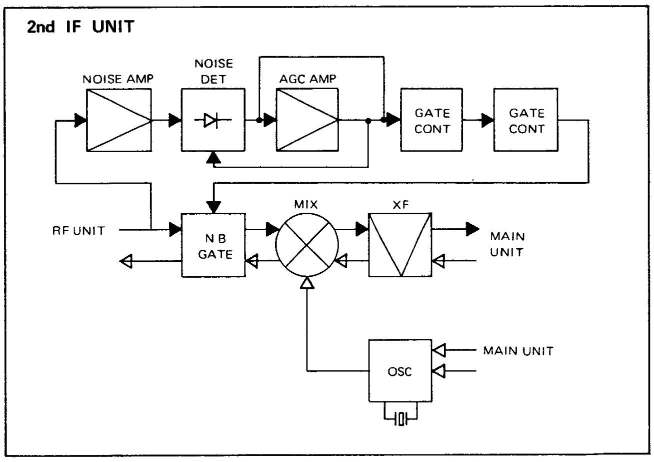
During receive, the incomming signal passes through the low-pass filter, is fed to the preamplifier circuit. If the PREAMP switch on the front panel is in ON position, the signal passes through the preamplifier and is amplified about 10 dB, then fed to the band-pass filter. If the PREAMP switch is in OFF position, the signal is directly fed to the band-pass filter. The band-pass filter is selected its respective filter depending on the band selected.

The signal is then passed through a high-level Double Balanced Mixer which has an 18 dBm intercept point, where it is mixed with the 1st Local Oscillator signal from the BPF unit, becoming a 39MHz signal, passes through a third over-tone monolithic filter and is amplified by Q6, 1st IF amplifier, passes again through a monolithic filter, and is fed to the 2nd IF unit.

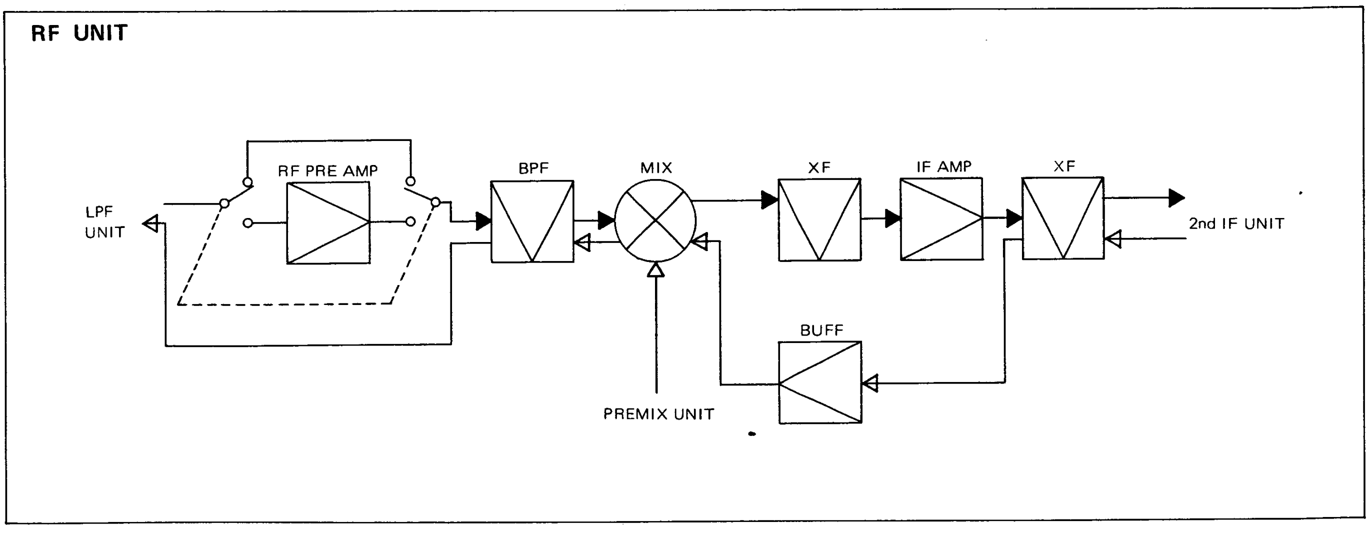
During transmit, the 39MHz signal from the 2nd IF unit, passes through the monolithic filter, then the 1st mixer, the reverse of receive, then to the band-pass filter, and is amplified by Q4 and fed to the PA unit.

6-3 2nd IF UNIT

Composed of the 2nd mixer, 2nd local oscillator, noise blanker circuit, and a crystal filter for AM and optional SSB and CW filter circuits.



During receive, the 39MHz signal from the RF unit is fed to the 2nd mixer which is a high level DBM, and mixed with 30.72MHz 2nd local oscillator signal to convert it in 9.0115 MHz 2nd IF signal.



The 2nd local oscillator is a VXO (Variable Crystal Oscillator), and its frequency is varied 30.71901MHz~30.72000 MHz in 10Hz steps, and 30.7191MHz ~ 30.7200MHz in 100Hz steps by the output signals of the CPU through the D/A converter.

A part of incomming 39MHz signals is fed to the noise blanker circuit. The noise blanker consists of noise amplifiers, a noise detector and noise blanker gate control which blocks the incomming IF signal when noise is present.

The AGC time constant of the noise blanker circuit can be changed. It becomes effective for wider noise pulse such as "woodpecker noise".

The 9.0115MHz 2nd IF signal passes through the AM crystal filter, and is then fed to the MAIN unit. If the optional SSB crystal filter, FL-30, and/or CW crystal filter, FL-45 is installed, the suitable crystal filter is selected by the mode switch.

During transmit, the 9.0115MHz transmitting signal from MAIN unit passes through the crystal filter and is fed to the 2nd mixer to convert 39MHz signal. This output signal is fed to the RF unit described above.

6-4 MAIN UNIT

Composed of 2nd IF Amplifiers, IF pass-band shift circuit, AF amplifier, MIC amplifier, TX IF amplifier, VOX circuit, ANTI-VOX circuit, CW monitor, ALC circuit, and meter control circuit. During receive, the 9MHz 2nd IF signal from the 2nd IF unit is amplified and then fed to the IF Pass-Band shift circuit.

In this circuit, the 9.0115MHz signal is mixed with 9.4665 MHz local oscillator signal to convert the 9.0115MHz signal into a 455KHz signal.

This 455KHz signal is fed to a 455KHz ceramic filter in AM mode, or to a mechanical filter in SSB and CW mode, then again mixed with 9.4665MHz local oscillator to convert the 455KHz signal into the original 9.0115MHz signal.

The 9.4665MHz local oscillator frequency can be changed ±1.5KHz by sliding the IF SHIFT control to move the IF Pass-Band center frequency. If installed the optional SSB filter, FL-30, this circuit becomes Pass-Band Tuning circuit.

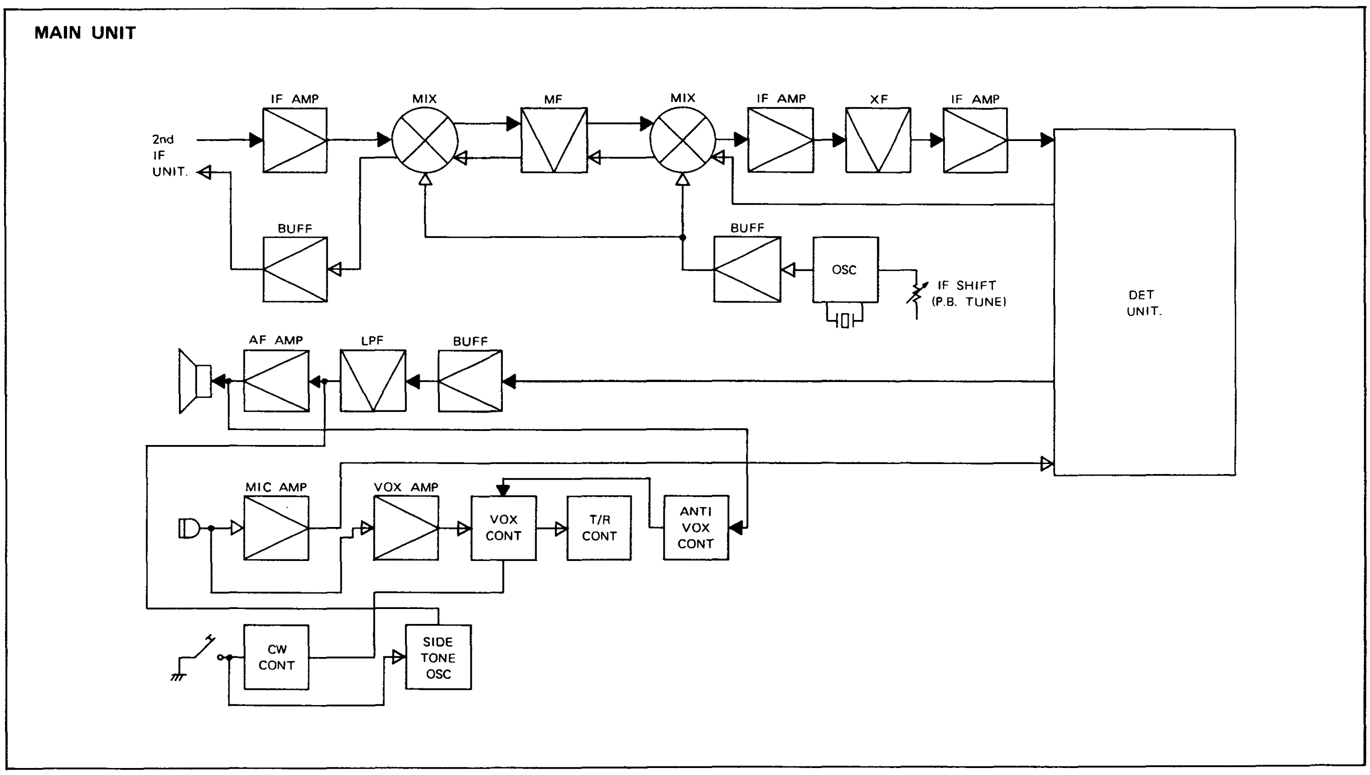
The 9.0115MHz IF signal is sent to the DET unit, and demodulated AF signal is applied to this unit again, and amplified by AF power amplifier to drive the speaker.

In VOX operation, a part of the AF output signals is applied to the ANTI-VOX circuit, and its output voltage is fed to the VOX circuit to prevent misfunction of the VOX by an audio from the speaker.

In the CW mode, the side-tone oscillator is keyed according to your keying, and its output signal is fed to the AF power amplifier.

A voice signal from the microphone is applied to the MIC amplifier, and speech processor circuit and fed to the modulation circuit on the DET unit.

The 9.0115MHz DSB suppressed carrier from the DET unit is applied the mixer to convert 455KHz signal, then it is fed to 455KHz mechanical filter and removed unwanted side band, and an SSB signal is produced. This signal is converted to 9.0115MHz SSB signal and fed to the 2nd IF unit through a buffer amplifier.



The IC-730 has a PA protection circuit which detects reflected power, and ALC condition.

If some problem occurs, such as mismatching of the antenna, the circuit reduces the driving power to the final power transistors, and protects them.

6-5 DET UNIT

Composed IF amplifier, AGC circuit, AM detector, SSB/CW detector, modulation circuit and BFO circuit.

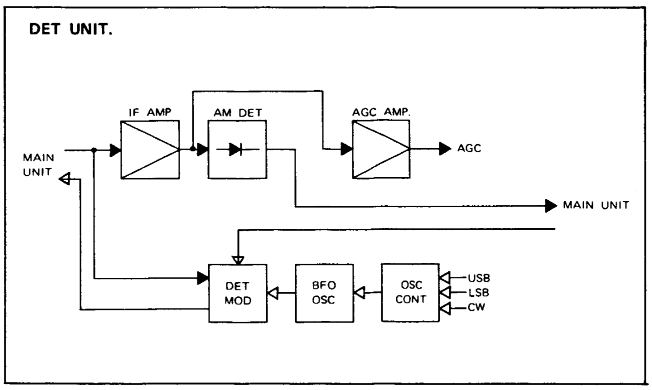
During receive, SSB or CW signal from the MAIN unit, is directly fed to a product detector IC with respective BFO signal of each mode.

The detected AF signal is fed to a buffer amplifier, then an active low-pass filter and cut out high frequency component, then sent the AF power amplifier in the MAIN unit.

AM signal from the MAIN unit, is fed to an IF amplifier, then an AM detector. The detected AF signal is fed to a buffer amplifier, then the same active low-pass filter that for SSB or CW signal.

A part of the amplified IF signals is rectified for AGC, and drives AGC DC amplifier. The AGC voltage is superimposed with the RF GAIN control voltage, and applied to the IF amplifiers.

During transmit, the AF signal from MIC amplifier in the MAIN unit, is applied to the balanced modulator IC with the BFO signal, the same as receive, and produced a double sideband suppressed carrier signal. This DSB signal is sent to the 2nd IF unit and changed into an SSB signal.
In AM or CW mode, the balanced modulator is unbalanced, and puts out a carrier for CW or AM signal. This signal is sent to the 2nd IF unit the same as SSB.



6-6 PA UNIT

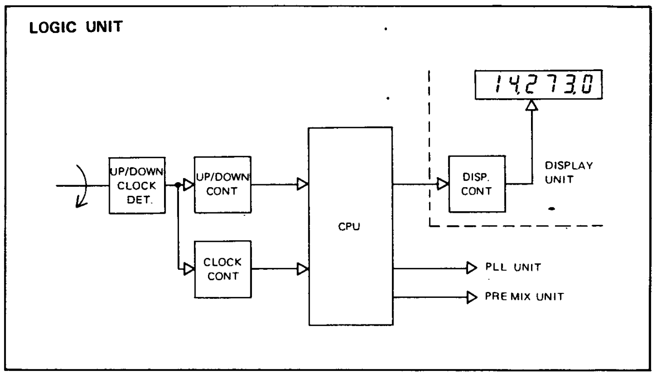
This unit is made up of three stage wideband amplifiers, negative feedback circuits for giving a gain flatness response across the bands, and thermal switch that monitor the temperature of the final transistors and control the speed of the cooling fan. The signal from the RF unit is applied this unit and amplified to 100 watts.

6-7 LOGIC UNIT

This unit is composed of an incorporated CPU for treating data such as up/down signal detection control, the dial lock control circuit, the tuning rate circuit, and the I/O control circuit.

The dial clock signals are generated by the photo-chopper directly connected to the tuning knob. The up/down control circuit detects the rotating direction of the tuning knob, and puts out the up/down control signal for the CPU.

The CPU is a 4-bit microcomputer which has a program to control the set. The CPU's function are determined by the input signals, such as the dial clock signal, up/down signal and the signals from the function switches, and the CPU puts out signals to control the operating frequency, tuning steps, display, and so on.



6-8 DISPLAY UNIT

Composed of a luminescent display tube, display control circuit and DC-DC converter.

The operating frequency data from the CPU in the LOGIC unit, are applied to the display control IC, and it puts out 7 segment data and digit control signals and displays operating frequency. The DC-DC converter produces a filament voltage and high voltage for display tube, and –5V for IC's and AGC circuit.

6-9 PLL UNIT

This unit is composed of a mixed down type Phase-Locked Loop and a high speed 1/10 divider. The local oscillator of the PLL consists of a 13.66MHz crystal oscillator and two stage triplers, and puts out 123MHz signal.

The VCO oscillates 132MHz ~ 139MHz, and is mixed with 123MHz local oscillator signal, and mixed down to 9MHz ~ 16MHz. This signal is fed to a programmable divider in the PLL IC and divided to 10KHz and compared with 10KHz reference frequency which is divided from 9MHz, crystal oscillator, and locked up to the reference frequency. The programmable divider is controlled by the frequency data from the CPU.

The VCO output is fed to the 1/10 divider and the resulting

13.2MHz ~ 13.9MHz signal with 1KHz steps, and sent to the PREMIX unit.

The local oscillator is a VXO, and its frequency is varied few KHz by the RIT control and the FREQUENCY SET control for calibration.

6 - 10 PREMIX UNIT

The 13.2MHz ~ 13.9MHz signal from the PLL unit, is fed to a mixer with a local oscillator frequency which is selected by the BAND switch, and the mixer puts out the respective 1st local oscillator frequency. This output signal is fed to the BPF unit to suppress spurious signals.

The local oscillator frequency (X) can be calculated as follows:

X (MHz) = 39.7315MHz + (low edge frequency of the band) MHz − 13.2MHz

This unit has a diode matrix circuit which convert the band signal into the control signals for the CPU.

6 - 11 BPF UNIT

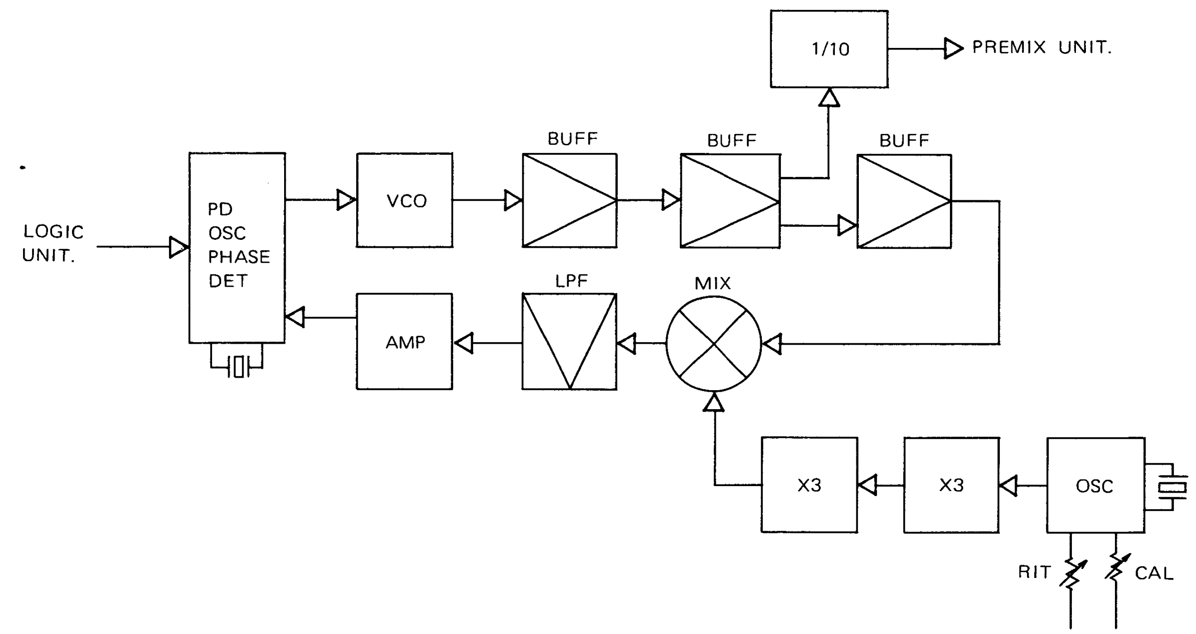
Consists of a band-pass filter for each band and buffer amplifier.

The 1st local oscillator signal from the PREMIX unit, is applied suitable band-pass filter which is selected by the BAND switch.
The filtered signal is amplified and sent to the 1st mixer in the RF unit.

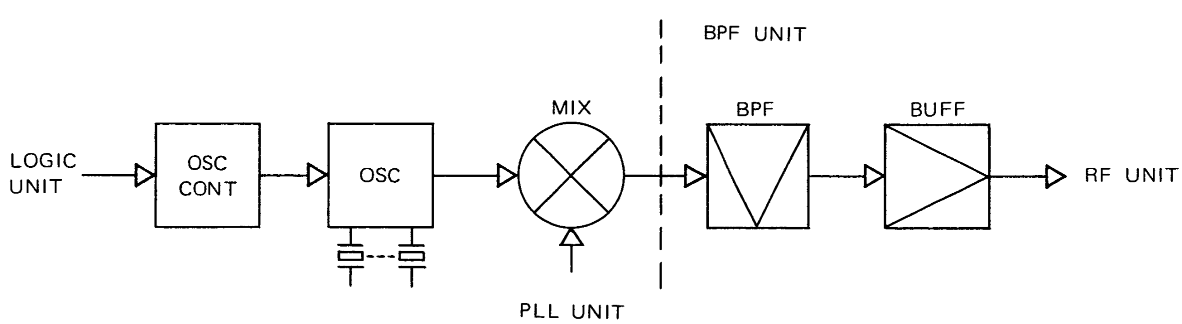
6 - 12 REG UNIT

Composed of a voltage regulator IC and a current booster transistor. These provide regulated 8V for receive, for transmit and for common circuits.

PLL UNIT

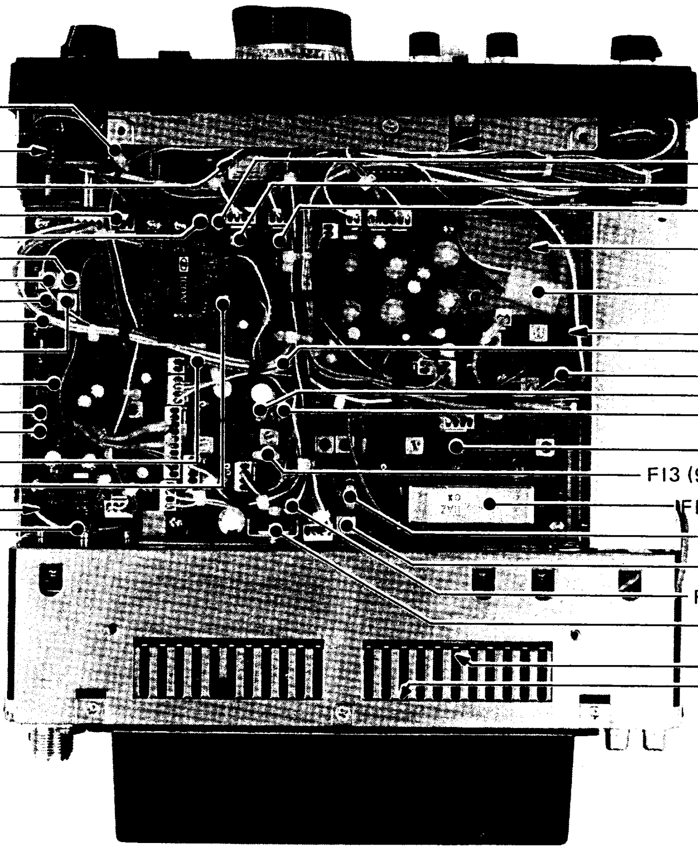


PRE MIX UNIT

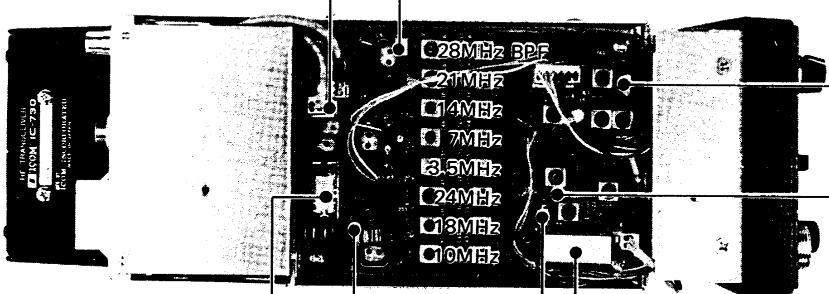


SECTION 7 INSIDE VIEWS

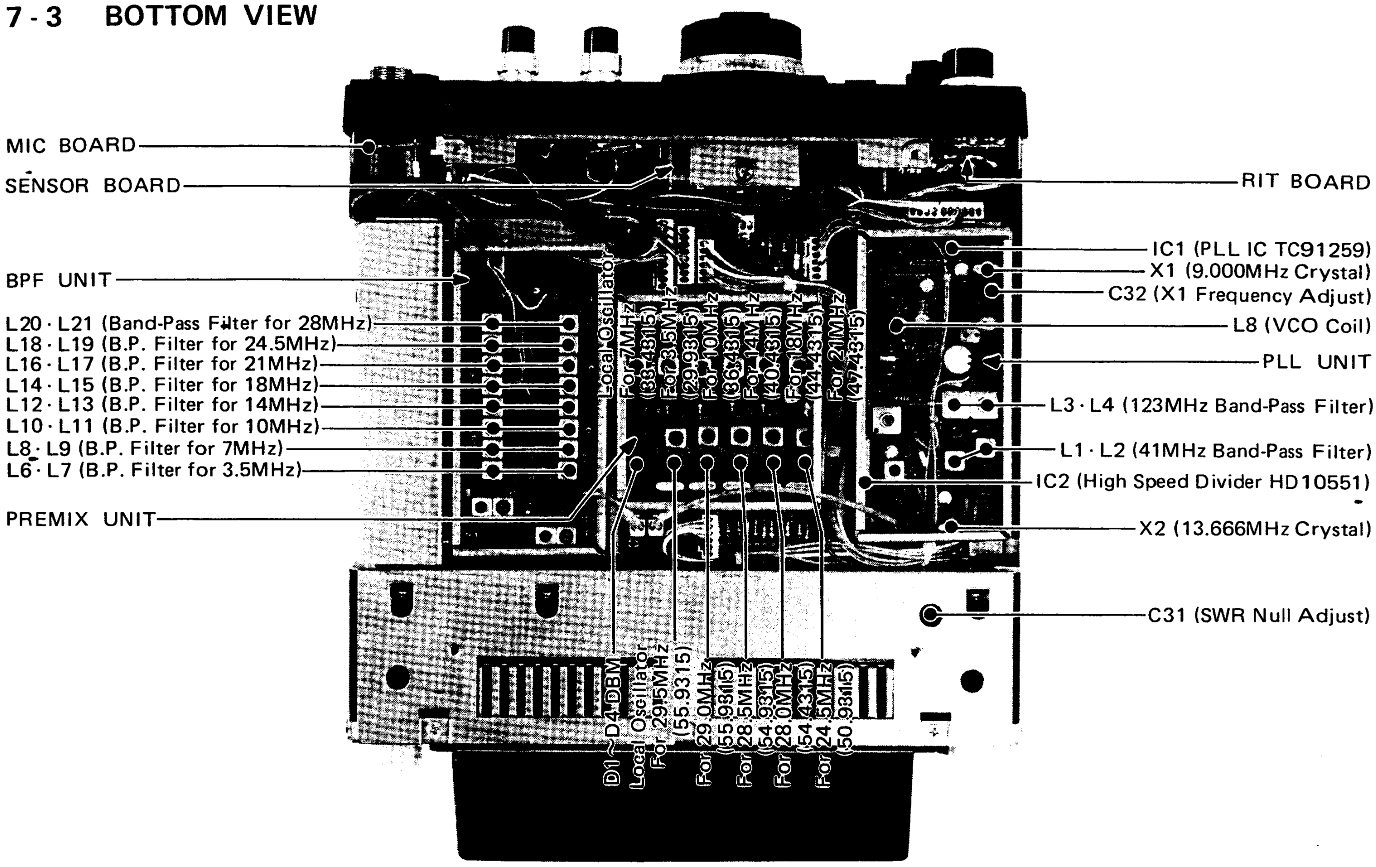
7-1 TOP VIEW



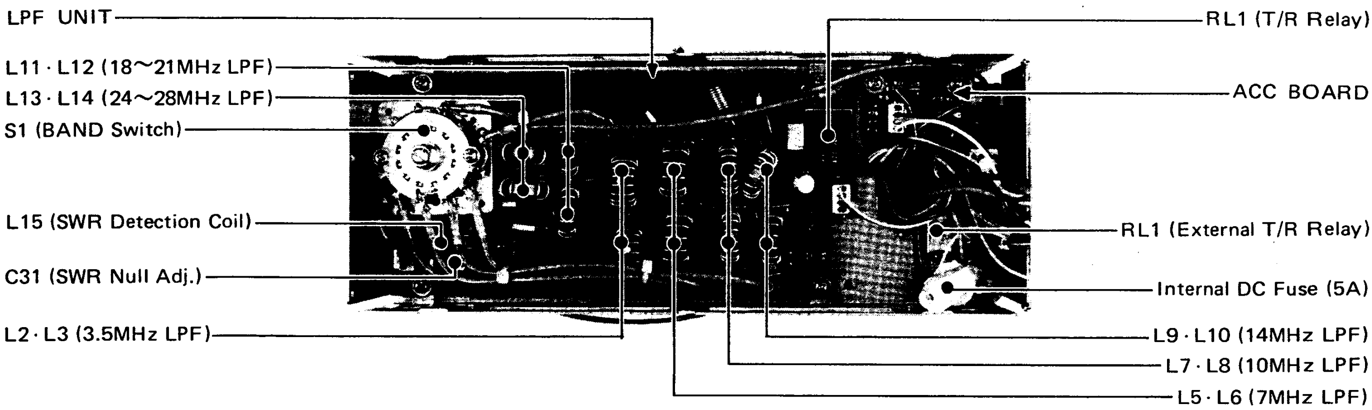
7-2 RF UNIT



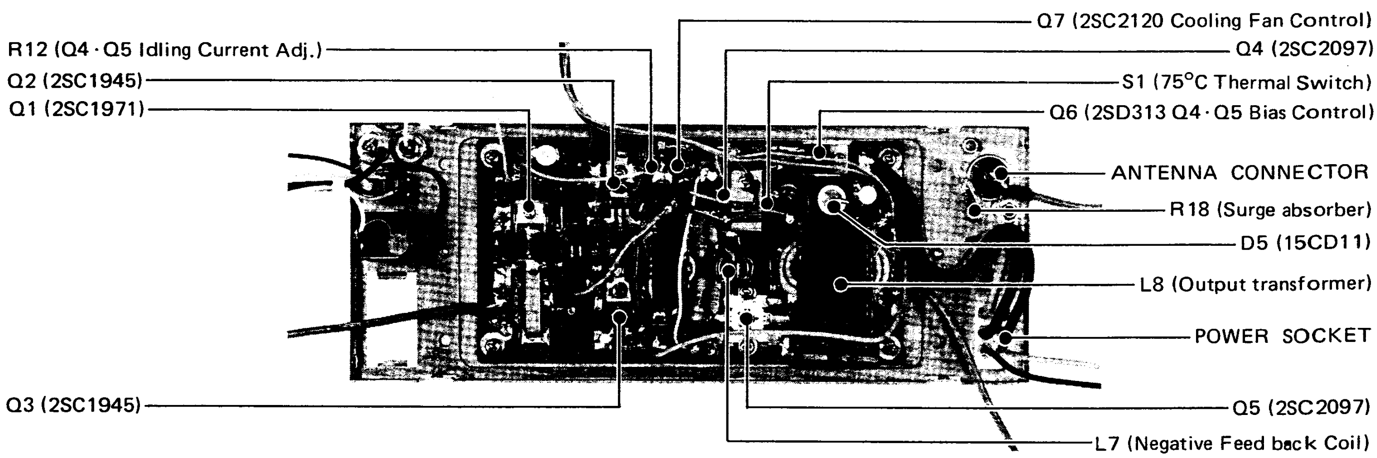
7-3 BOTTOM VIEW



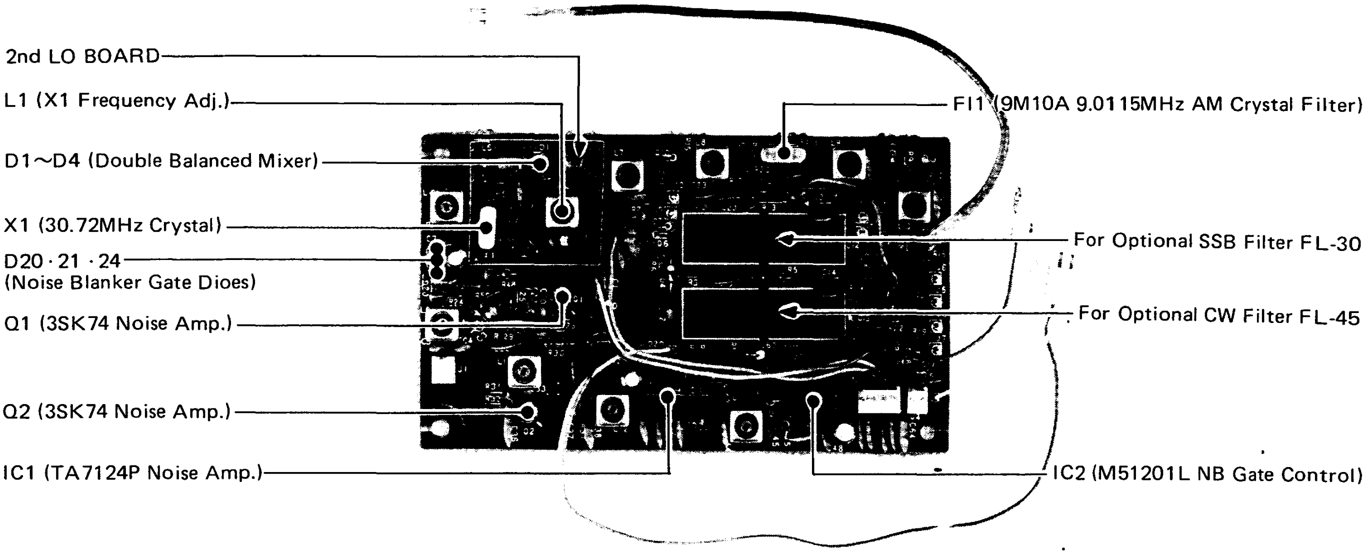
7-4 LPF UNIT and ACC BOARD



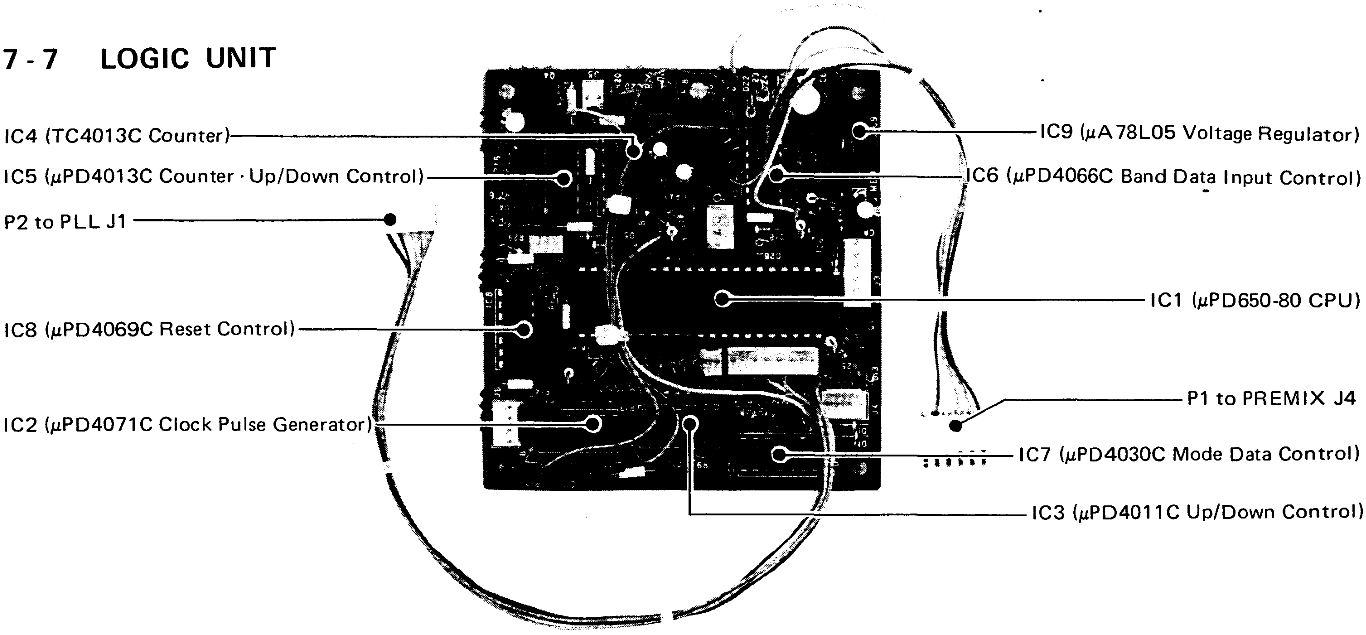
7-5 PA UNIT



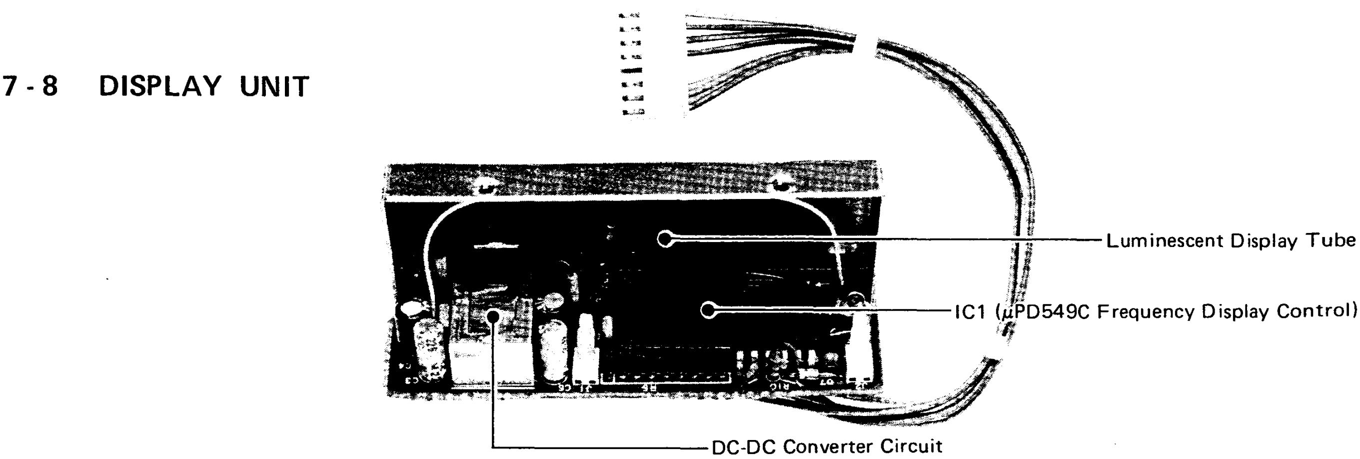
7-6 2nd IF UNIT



7-7 LOGIC UNIT



7-8 DISPLAY UNIT



SECTION 8 TROUBLE SHOOTING

Your IC-730 has been carefully adjusted at the factory prior to shipping. The chart below has been provided to help you correct problems which are not equipment malfunctions. If you are unable to locate the trouble, or correct the fault, please contact your dealer or the nearest ICOM Service Center.

Problem	Possible Cause	Solution
1. Power does not come on when the switch is pushed.	Power cable is improperly connected.	Carefully reconnect power cable.
	Power cord is connected with the polarity reversed.	Disconnect the power cord, replace the blown fuse, then reconnect the power cord observing proper polarity.
	Blown fuse.	Check for the cause, then replace the fuse with a spare one.
		If using an IC-PS15, also check its fuse.
2. No sound comes from the speaker.	AF GAIN control knob is completely counterclockwise.	Turn the knob clockwise to a suitable level.
	The unit is in the transmit mode, either by the T/R switch or the PTT switch on the microphone.	Put the unit in the receive mode.
	The external speaker cable is connected to the unit but not to the external speaker jack on the external speaker.	Connect the cable to the speaker jack on the external speaker.
	The internal speaker cable is not connected.	Connect the speaker connection.
	A headphone is connected to the PHONES jack.	Unplug the headphone.
3. Sensitivity is low and only strong signals are audible.	RF GAIN control knob is turned counter-clockwise.	Turn the RF Gain control knob fully clockwise.
	The antenna feed line is cut or shorted.	Check the feed line and correct any improper condition.
4. During receive, the "S" meter is higher than the "0" position even when there is no signal.	RF GAIN control knob is turned counter-clockwise.	Turn the knob fully clockwise.
5. Only incomprehensible voices are heard during SSB reception.	Receiving the wrong sideband.	Set the sideband opposite the one you are using, either USB or LSB.
6. The tone of the received signal is very high or low pitched.	Maladjustment of the P.B. Shift control.	Set the P.B. Shift control knob to the clear tone position.
7. No output power or low output power.	MIC GAIN setting is too low.	Turn the MIC GAIN control clockwise to the center (12 o'clock) position, or more.
	When SSB is desired, but the MODE is in the CW or CW-N.	Set the MODE to the SSB (USB or LSB).
	PTT switch is not functioning due to improper connection of the mic connector.	Check the connection of the MIC connector and correct any problems.
	The antenna feed line is cut or shorted.	Check the antenna feed line and correct any improper connection.
8. The receive mode functions properly and your signals are transmitted, but you are unable to make contact with another station.	The NOR/SPT switch is in the SPT position.	Set the NOR/SPT switch to the NOR position.
	The receive frequency is offset from the transmit frequency by the RIT control.	Turn OFF the RIT, or set the RIT control knob to the center (12 o'clock) position.
9. The heat sink on the rear panel becomes hot.	The heat sink on the rear panel is for the final transistors and may become as hot as 40°C (104°F) above room temperature.	Make sure the area around the unit has as much ventilation as possible.

Problem	Possible Cause	Solution
10. The frequency does not change by rotating the Tuning knob.	DIAL LOCK is engaged.	Disengage the DIAL LOCK by pressing and releasing the DIAL LOCK switch.
11. An abnormal figure is displayed on the frequency display or fails to illuminate.	The Power switch was turned OFF and ON too quickly.	Turn the Power switch OFF, wait 30 seconds, and then turn it ON again.
12. An unusual amount of distortion and/or noise in the transmit signal.	The MIC GAIN is too high when the Speech Processor is ON.	While watching the meter in the ALC mode, turn the MIC GAIN control counterclockwise so that the meter is within marked zone at the voice peak.
13. Unable to key when using an electronic keyer.	The Switching circuit of the electronic keyer does not close completely.	Replace the keyer with one having a voltage of less than 0.4V between the two keying lines at the key down position, or modify your keyer so that the voltage is less than 0.4 Volts.
	Polarity of the connection wires from the keyer is reversed.	Connect the keyer wires observing proper polarity.
	The MODE is not in the CW or CW-N.	Place the MODE in the CW or CW-N.
14. In the AM mode there is no modulation.	Mic Gain is too low.	Adjust the Mic Gain clockwise.
	Mic connector loose, or microphone inoperable.	Check and tighten mic connections, replace mic if necessary.

CAUTION

This set employs a microcomputer to control frequencies, operating mode and display.

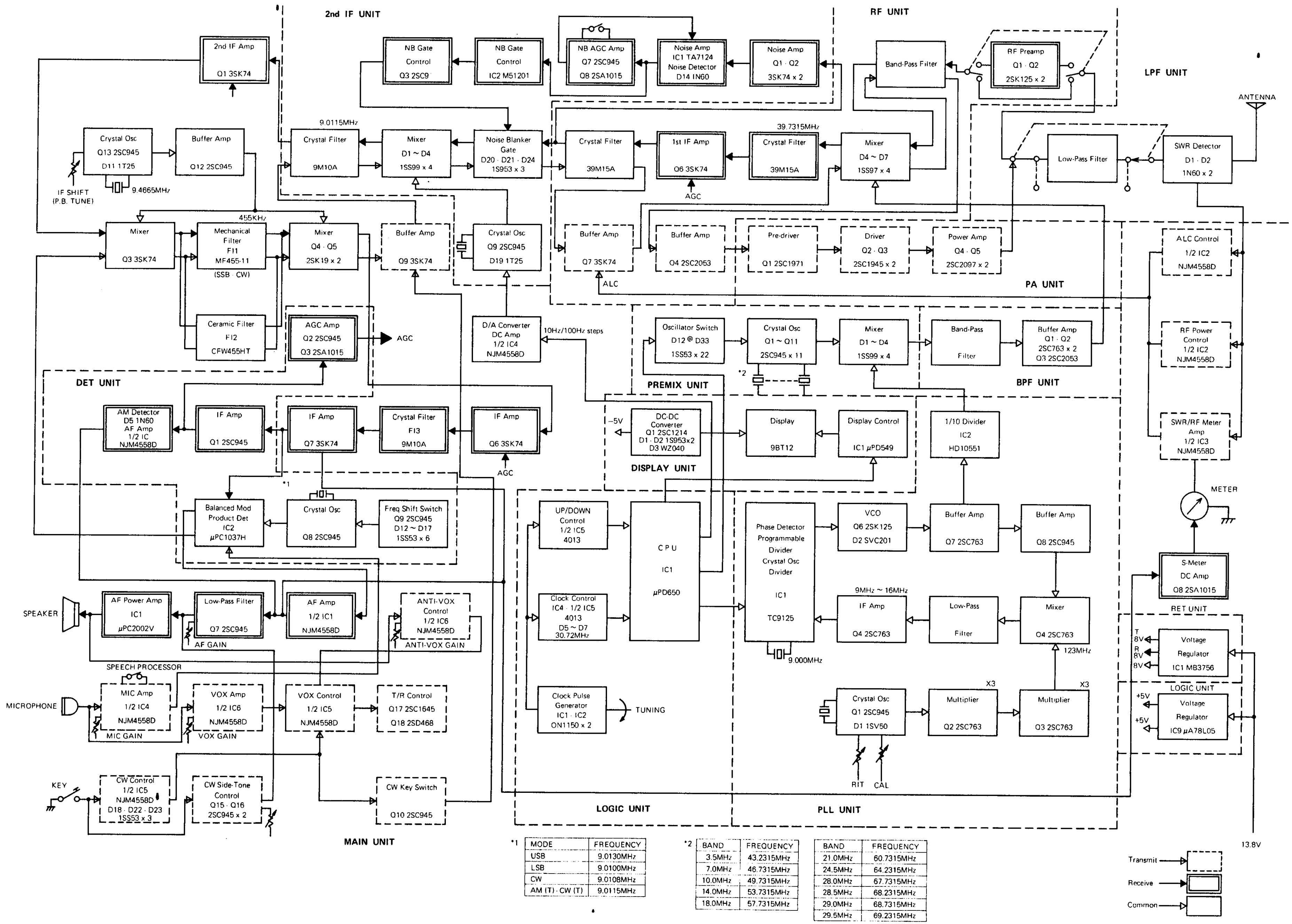
The microcomputer has a program to initialize the operating condition of the set. However, sometimes an abnormal figure may be displayed on the display fails to illuminate.

This may be caused by an intermittent connection of the power plug or the power switch being turned OFF and ON too quickly.

This is not an equipment malfunction. When this occurs, it may be solved with the following simple procedure:

1. Turn OFF the set's power switch.
2. If the set has a memory switch, turn OFF this switch also.
3. If you use a memory backup power supply, unplug its power connector.
4. Unplug the power plug of the set.
5. Wait at least 45 seconds and reconnect the power plug to the set.
6. Turn ON the power switch.
7. Make sure the set has the correct startup readout.
   (If not, repeat the above procedure.)
8. Turn ON the memory switch (when the set has one), connect the memory backup power connector (when used).

SECTION 9 BLOCK DIAGRAM

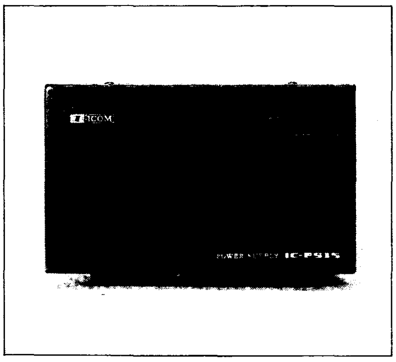


*1

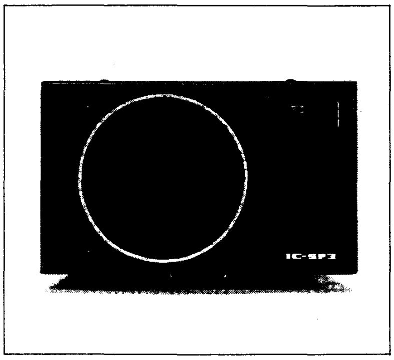
MODE	FREQUENCY
USB	9.0130MHz
LSB	9.0100MHz
CW	9.0108MHz
AM (T) · CW (T)	9.0115MHz

*2

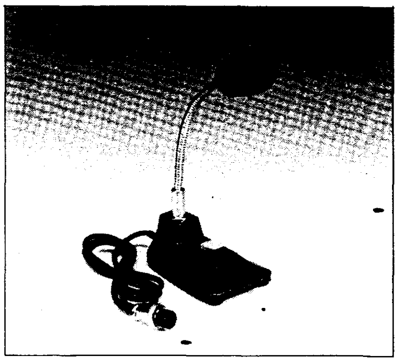
BAND	FREQUENCY
3.5MHz	43.2315MHz
7.0MHz	46.7315MHz
10.0MHz	49.7315MHz
14.0MHz	53.7315MHz
18.0MHz	57.7315MHz
21.0MHz	60.7315MHz
24.5MHz	64.2315MHz
28.0MHz	67.7315MHz
28.5MHz	68.2315MHz
29.0MHz	68.7315MHz
29.5MHz	69.2315MHz



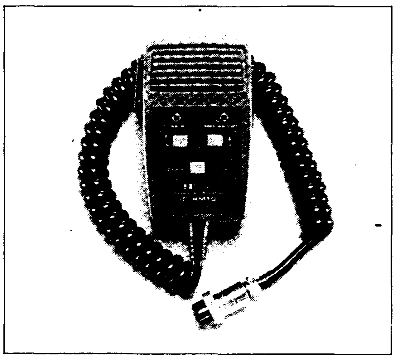
IC-PS15
AC POWER SUPPLY



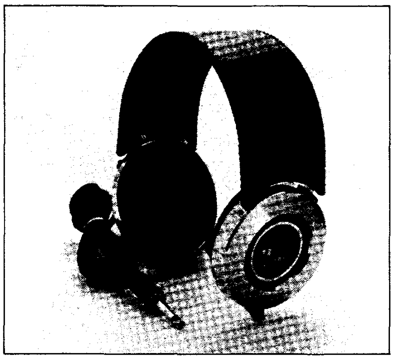
IC-SP3
EXTERNAL SPEAKER



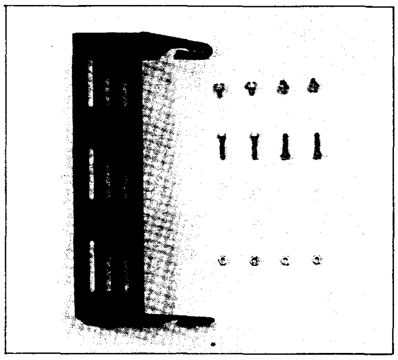
IC-SM5
ELECTRET CONDENSER TYPE DESK MICROPHONE



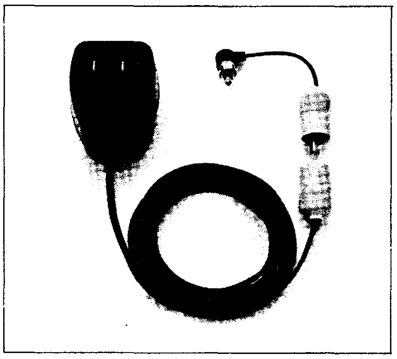
IC-HM10
SCANNING MICROPHONE



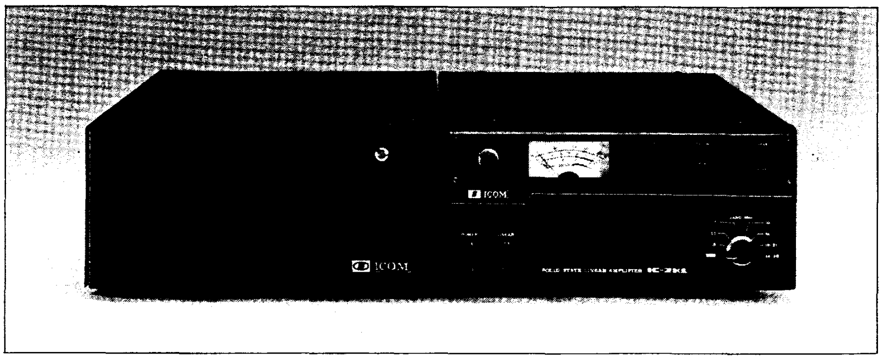
IC-HP1
HEADPHONES



IC-MB5
MOBILE MOUNTING BRACKET

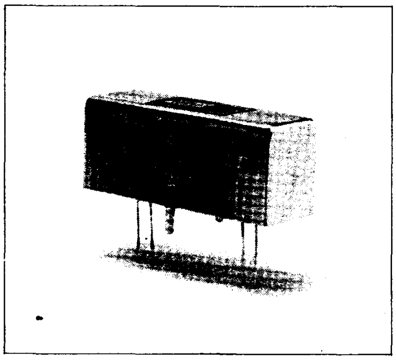


BC-10A
MEMORY BACKUP AC POWER SUPPLY



IC-2KLPS
ATTENDANT POWER SUPPLY FOR IC-2KL

IC-2KL
500W SOLID-STATE LINEAR AMPLIFIER



FL-45
CW NARROW CRYSTAL FILTER

FL-30
SSB PASS BAND TUNE CRYSTAL FILTER

MODEL	DESCRIPTION
IC-EX195	Marker unit for freq. calibration
IC-EX202	LDA unit for auto band switching
IC-EX203	CW audio filter 150Hz/6dB
IC-EX205	TRV unit for transverter switching
FL-44	455KHz SSB crystal filter
IC-AH1	3.5 ~ 28MHz mobile antenna

ICOM

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